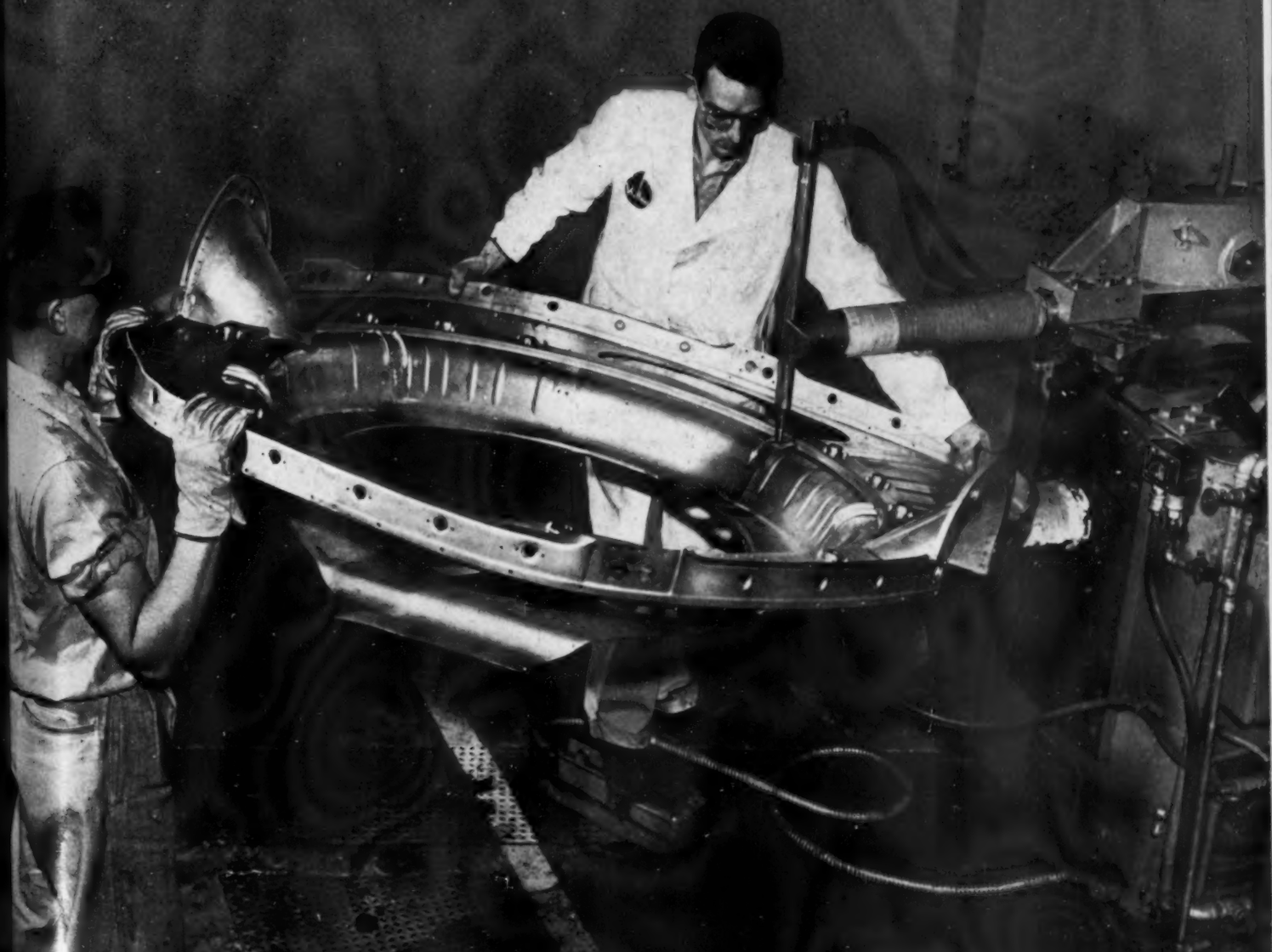
AMERICAN MACHINIST

OCTOBER 1, 1942



METAL SHOW NUMBER

1. Yesterday we had 20 salesmen, today they are your field service engineers — for the duration. And these service engineers can really help you. If you have any kind of problem involving precision boring and grinding you'll find their common sense and practical experience invaluable. To get a Heald Service Engineer, just call the nearest Heald branch office. Then take him out in the shop, on the job. Solving finishing problems day after day will probably produce a quick answer to yours. Or perhaps he'll suggest some improvement, some better way to "up" production, improve finish and accuracy. If it's a brand new finishing operation he can recommend the most efficient equipment for the job, he'll get you production estimates and costs. But regardless of your kind of problem, as long as it's precision finishing you'll find your Heald Service Engineers a convenient source of expert on-the-spot consultation. And remember, all you need to get this service is the nearest telephone.

ARMY E NAVY

Heald 3 POINT SERVICE
Keeps Production Rolling

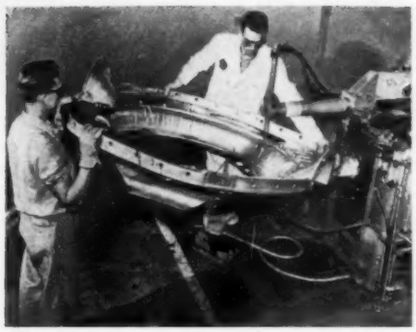
1. Field Engineering Service
2. Factory Engineering Service
3. Demonstration and Maintenance Service

THE HEALD MACHINE CO. WORCESTER, MASS., U. S. A

MANUFACTURERS OF PRECISION BORING AND PRECISION GRINDING MACHINES

AMERICAN MACHINIST

October 1, 1942



On the Spot—Welding is completed on an inner ring after enough spots have been jig welded to make it rigid

MASON BRITTON, Vice-President
FRED H. COLVIN, Editor Emeritus
BURNHAM FINNEY, Editor
KENNETH H. CONDIT, Consulting Editor
JOHN HAYDOCK, Managing Editor
BEN C. BROSHEER — WILLIAM J. HARGEST
Associate Editors
ANDERSON ASHBURN — E. C. HAINES
PAUL WOOTON, Chief, Washington Bureau — RUPERT LE GRAND, Detroit Editor
BLAINE STUBBLEFIELD — ROBERT COLBORN
Washington Correspondents
N. O. WYNKOOP, Publisher
W. E. KENNEDY, Manager

McGraw-Hill Publishing Company, Inc.

Editorial and executive offices, 330 West 42 Street, New York, N. Y. Publication office, 99-129 North Broadway, Albany, N. Y. Branch offices: Chicago, 520 North Michigan Ave.; San Francisco, 68 Post Street; Aldwych House, Aldwych, London, W.C. 2; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta.

JAMES H. McGRAW
Founder and Honorary Chairman
JAMES H. McGRAW, Jr., President — HOWARD EHRLICH, Executive Vice-President
MASON BRITTON, Vice-President — B. R. PUTNAM, Treasurer
JOSEPH A. GERARDI, Secretary — J. E. BLACKBURN, Jr., Director of Circulation

VOLUME 86 — Number 20

AMERICAN MACHINIST. Copyright 1942 by McGraw-Hill Publishing Co., Inc. Published every other Thursday, price 35c a copy. Allow ten days for change of address. Address all communications about subscriptions to the Director of Circulation, American Machinist, 330 West 42 Street, New York, N. Y. Subscription rates — United States, Canada, Mexico and Central and South American countries $5.00 a year, $8.00 for two years, $10.00 for three years. All other countries $8.00 a year, $13.00 for two years, $16.00 for three years. Entered as second class matter, September 29, 1936, at Post Office, Albany, N. Y., under the act of March 3, 1879. Printed in U.S.A. Cable address: "McGrawhill, New York." Member of A.B.P. Member of A.B.C.

A McGRAW-HILL PUBLICATION

PRINTED IN U. S. A.

METAL SHOW SECTION

The Battle of Metals 1063
Show in Print 1064
Directory of Exhibitors 1071
The Working of National Emergency Steels 1095

MAJOR ARTICLES

How to Use Hardness Tests ..... *T. H. Gray* 1075
New Uses of Induction Heating ..... *Rupert LeGrand* 1079
The Inside of Arc Welding 1082
Finishing Sprayed Metals ..... *W. C. Reid* 1084
Flame Hardening ..... *R. F. Apter and Harry W. Smith* 1088
Old Equipment Yields Scrap ..... *Walter McComb* 1091

ARMAMENT SECTION

Heat-Treatment of Aluminum Aircraft Parts ..... *T. E. Piper* 1107
Spray Booth Gives Quick Quench ..... *Royal B. Jackman* 1111
Welding Jigs for Nacelle Subassemblies ..... *Paul Mitchell* 1114
Seamless Bombs From Steel Plate ..... *J. B. Nealey* 1117

IDEAS FROM PRACTICAL MEN

Fine Threads in Aluminum and Brass ..... *Charles T. Stoeffler* 1092
Drilling Radial Holes in Disks ..... *John E. Hyler* 1092
Step-Out Valve Crosshead Pin ..... *A. H. Carroll* 1093
Lost-Motion in Throttle Levers ..... *Arthur Havens* 1093
Sheet Metal Stops Chattering ..... *F. S. McGibbon* 1094
How to Remove Varnish ..... *C. T. Packer* 1094

NEWS OF THE INDUSTRY

Gaging Business 1126b
Inside Detroit 1126g
War Orders in Brief. 1126h
Wartime Washington. 1126i
Names in the News.. 1126k
Obituaries 1126l

DEPARTMENTS

What's in This Issue.. 71
Reference Book Sheet. 1123
Editorial 1126a
Shop Equipment News 1127
New Materials 1138
Trade Publications ... 1140
New Books 1143
To the Editor..... 1147

Answers TO YOUR *Questions* In This WARTIME METAL SHOW NUMBER

Q. What New Equipment Will be Exhibited at the Show?

A. This issue gives a preview . . . illustrations and detailed descriptions of equipment to be shown for the first time. Check the list of exhibitors—plan your survey of the Show. Whether or not you attend, this is your permanent record of "what's new".

Q. What Alternates Can I Use for Higher Alloy Steels?

A. Study carefully the "blue section" on National Emergency Steels—fifteenth Working of Materials Section. It gives practical working data on many steels you may never before have used extensively.

Q. What's Being Done in Heat-Treating Today?

A. You'll find a detailed discussion of "Heat-Treating Aluminum Alloys in the Aircraft Industry" . . . the 55th special Armament Section of *American Machinist.* Also the concluding chapter of the serial on "Flame Hardening with City Gas" . . . an article packed full of valuable data. Another feature is the article on "Hardness-Testing"—an important Show-time topic.

Q. Can I Learn Anything New About Welding?

A. Once merely a repairing process, now an important production-line method of fabrication, welding keeps going places. You'll find a lot of up-to-the-minute information in the article on "Welding in the Aircraft Industry."

Q. What's Being Done in Metal Spraying?

A. "Metal Coating by Spraying" gives the latest developments of a process that the war has brought into sharp focus.

Q. Where Can I Buy the Products I Need . . . and Get the Most Out of What I Have?

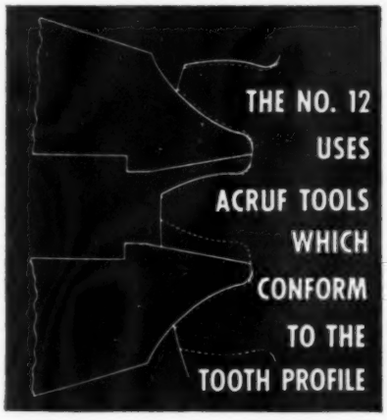
A. Go through, page by page, the advertisements of the manufacturers who are trying their best to supply you with the goods and "know-how" that will help you produce and keep producing.

THESE HIGHLIGHTS—Plus the many other features in this issue —will give you the latest and best information in metal-working. Give them your close study . . . and keep this number for reference.

GLEASON NO. 12 TWO-TOOL ROUGHER

With the new No. 12 Rougher, fast and extremely close roughing is extended to straight bevel gears and pinions, both in the smaller lot quantities and with front hubs.

The No. 12 operates without generating roll and uses new Acruf tools which leave only a small amount of stock over the entire tooth surface to be removed in finishing. With minor changes in the cycle of the finishing machine, a better tooth finish at savings in finishing time from 35 to 50 per cent is obtained on gears which have been Acrufed on the No. 12.



Send prints together with quantity requirements for complete information on how this new Rougher can reduce your gear cutting costs.

SPECIFICATIONS

Maximum Pitch Diameter	**18″**
Ratios	**1-1 to 10-1**
Coarsest Pitch	**4 D.P.**
Maximum Face Width	**2½″**
Index Range	**5 to 200 teeth**
Floor Space	**63″ x 89″**

GLEASON

GLEASON WORKS

Builders of Bevel Gear Machinery for Over Seventy-five Years

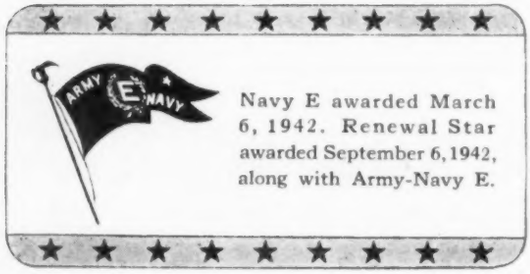
1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

Keep

WITH THIS FEED

There's nothing more discouraging to production men than to see a set of expensive cutters broken while in use, or to hear that a machine has been shut down because of mechanical or motor failure induced by overload. Many of these delays can be eliminated by merely using the right feed and cutter speed. In milling, these two fundamentals of production can be selected quickly with the CINCINNATI Milling Speed and Feed Calculator. Then, too, it's just as valuable at the other extreme of production, wherein machines and cutters are run overcautiously slow.

The Calculator is a natural outgrowth of our efforts to build milling machines which are easy for the average man to operate, to make him feel sure of the accuracy and finish he can obtain. Based upon more than fifty-eight years' experience in building CINCINNATI Milling Machines, this Calculator is in effect an official communique from the world's headquarters on milling machines and their uses.



Navy E awarded March 6, 1942. Renewal Star awarded September 6, 1942, along with Army-Navy E.

THE CINCINNATI

TOOL ROOM AND MANUFACTURING

'em cutting

SPEED AND CALCULATOR ➡

THE CINCINNATI MILLING MACHINE CO.
Milling Speed Calculator
DEPTH OF CUT
NUMBER OF TEETH IN CUTTER
WORK MATERIALS
FEED PER TOOTH—INCHES
Quickly Select the RIGHT FEEDS and SPEEDS with a CINCINNATI MILLING Calculator

The cost of the CINCINNATI Milling Speed and Feed Calculator, together with instruction book (illustrated at right), is 50 cents. Help to keep 'em cutting—send for your calculator today.

MILLING MACHINE CO. CINCINNATI, OHIO, U. S. A.

MILLING MACHINES • SURFACE BROACHING MACHINES • CUTTER SHARPENING MACHINES

Incredible Uncle Ishmael

UNCLE ISH is the derndest feller. He paid 4½ cents for that weapon, and he can shoot a clay pipe right out of your mouth at 100 yards. What's more, he's a one-man army . . . Incredible? Well, here are the facts:

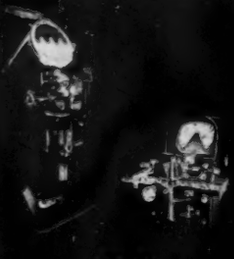
The famous Robbins and Lawrence Company, ancestors of Jones & Lamson, had working for them in the 1850's two of the greatest gunsmiths the world has ever known. Their names were Albert Ball and Benjamin Tyler Henry, and between them they invented and developed a gun that was to make history.

That gun is known throughout the world today as the famous Winchester rifle — but in its earliest form, back in Uncle Ishmael's time, it was known only as a headache to Robbins and Lawrence. For there was a large order from the government for this revolutionary firearm, to replace the muzzle-loaders being used in the Civil War, but the war ended before delivery could be made.

The result: Hundreds of these repeating rifles were put up for sale at one-half cent a pound — and Uncle Ishmael got one. Nine pounds of the greatest gun ever made, for 4½ cents!

FAY AUTOMATIC LATHES

AUTOMATIC THREAD GRINDERS



OPTICAL COMPARATORS

AUTOMATIC OPENING DIE HEADS

...the One-man Army!

LATER, when the gun was first known as the Winchester Repeating Rifle, an early poster told how Uncle Ishmael was a one-man army. It was an advertisement for the rifle, and it read: "A man armed with one of these rifles can load and discharge one shot every second, so that he is equal to a company every minute, a regiment every ten minutes, a brigade every half-hour, and a division every hour!"

The company which first produced that famous firearm is known today as Jones & Lamson, and the gun is typical of many great American products that have stemmed from the tools — and the men — developed by this company.

Jones & Lamson engineers and service men are at your call today . . . right now . . . in helping you to solve the difficult problems of present and post-war readjustment.

JONES & LAMSON
MACHINE COMPANY

Manufacturers of Ram & Saddle Type Universal Turret Lathes . . . Fay Automatic Lathes . . . Automatic Thread Grinding Machines . . . Comparators . . . Automatic Opening Threading Dies and Chasers

SPRINGFIELD
VERMONT, U.S.A.

SADDLE TYPE
UNIVERSAL TURRET LATHE

PROFIT PRODUCING
MACHINE TOOLS

RAM TYPE
UNIVERSAL TURRET LATHE

FELLOWS

MACHINES AND TOOLS FOR GEAR PRODUCTION

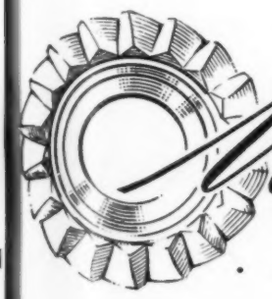
DOUBT, ASK US

IF THE FELLOWS PRINCIPLE CAN BE APPLIED

Many parts other than gears, are being made on standard Gear Shapers; also, special or semi-special attachments and special Gear Shapers are performing operations which would have required costly single-purpose machines. The versatility of application of the Gear Shaper principle has been put to good use in many of the plants engaged in the war program.

Remember: Fellows Cutters can be ground for machining an infinite variety of shapes from plain circular outlines to complicated combinations of a variety of shapes with regular or interrupted spacing. Another Gear Shaper advantage is the ability to produce such shapes on internal as well as external surfaces.

Gear Shaper Engineering service has been instrumental in increasing production, and cutting costs. If you are in need of assistance, write, wire or telephone—The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Building, Detroit, or 640 West Town Office Building, Chicago.



Method

. . . . FROM BLANK TO FINISHED GEAR

Any one or all three of these publications will be sent free on request. They're part of our effort to help win the war. Be sure to mention names of booklets you desire.

CINCINNATI

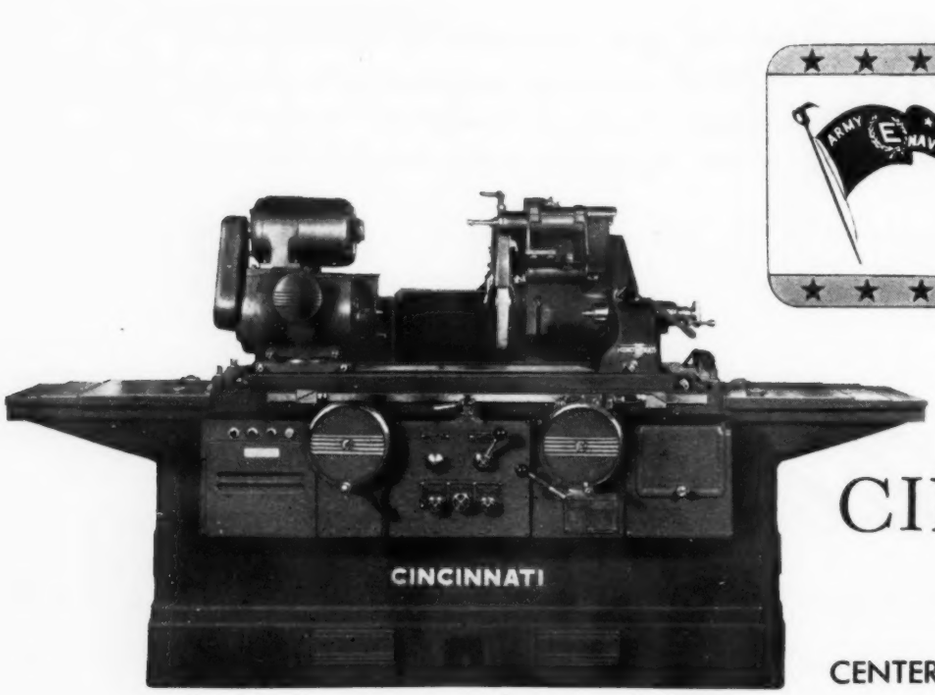
Booklets to help y

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

ARMY E NAVY

Navy E awarded March 6, 1942. Renewal Star awarded September 6, 1942, along with Army-Navy E.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★



CINCINNATI GR

CINCI

CENTER TYPE GRINDING MACHINES CENTE

p your GRINDING MEN

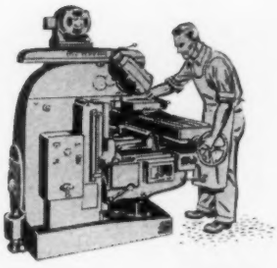
The three booklets illustrated above — "A Review of the Grinding Theories," "Filmatic," and "The Use of Abrasives for Finishing and Removing Metals" — are official communiques from Grinding Headquarters. They will give your workers a more thorough understanding of precision cylindrical grinding. With this more intimate knowledge should come a clue to finer finishes and closer accuracy of precision ground parts in your own shop.

The same minds which developed such precise grinding machines as the CINCINNATI Hydraulic Universal have been applied to the preparation of these booklets. Edited by skilled technical writers, they tell their stories correctly and effectively. Send for your copies today . . and to familiarize yourself with the outstanding performance characteristics of the CINCINNATI Hydraulic Universal, you'll also want a copy of catalogs G-486 and G-474.

TI GRINDERS INCORPORATED

CINCINNATI, OHIO, U. S. A.

HINES CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES



OPERATORS ALWAYS HAVE

"Control of the Situation"

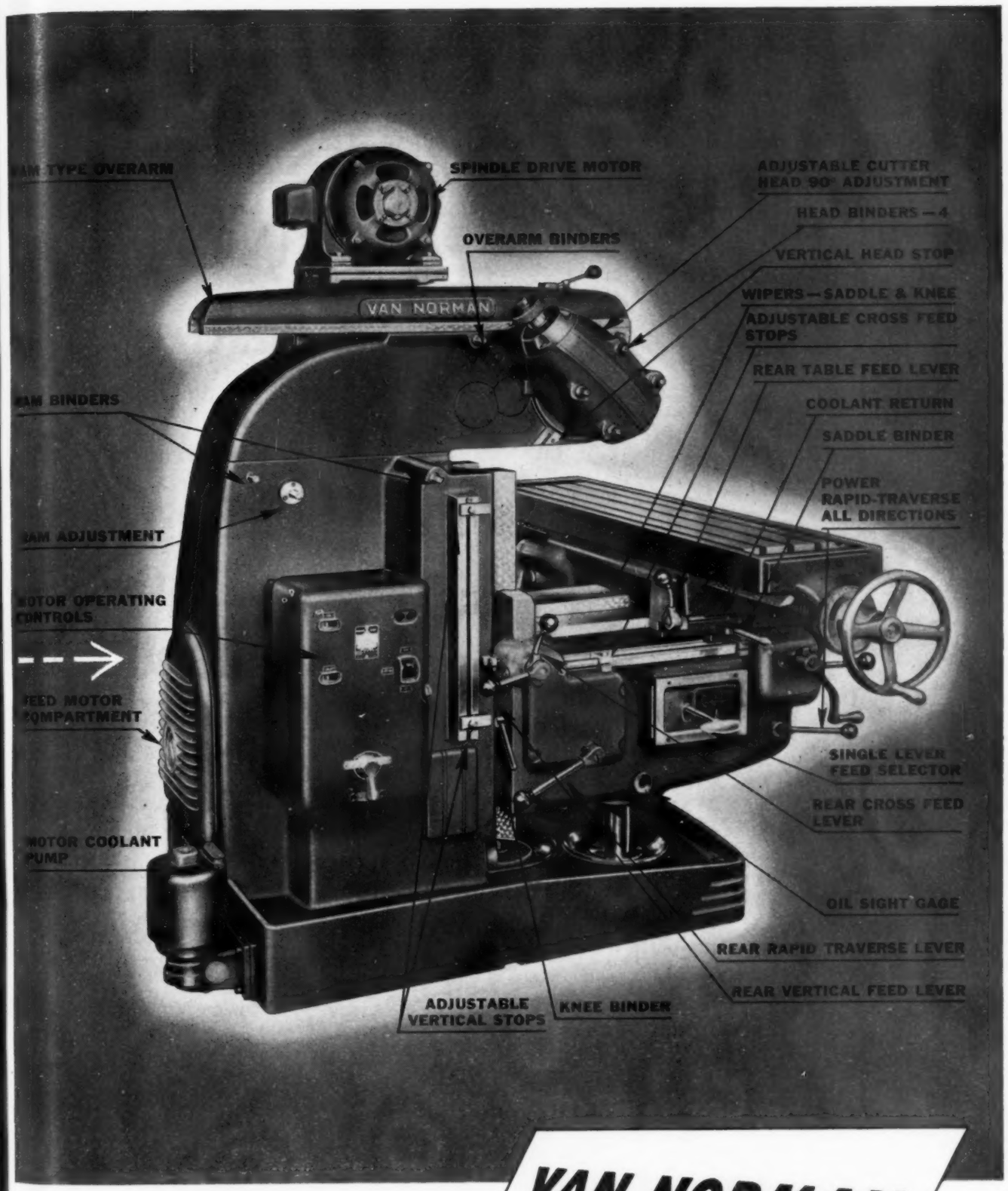
...ON VAN NORMAN RAM-TYPE MILLERS

All controls and adjustments are right at hand . . . quick and easy to use . . . on Van Norman Ram-Type Millers. So operators can turn out better work and more of it, in less time. Operators also find their work lightened and speeded up by front-and-rear controls of power feeds and 6-way rapid traverse . . . single-lever selectors of feeds and speeds . . . and large, glare-proofed dials that are easy to read.

Many jobs can be carried to completion . . . through successive vertical, angular and horizontal cuts on the same machine . . . simply by resetting the cutterhead, instead of taking the time (and the risk of errors) otherwise required to reset the work. In fact, every feature of Van Norman Ram-Type Millers is designed to combine highest accuracy with greatest ease of operation, on toolroom and production jobs.

SPECIFICATIONS:
No. 26 RAM-TYPE MILLER:
Table: 50" x 12"
Range: 28" longitudinal, 12" cross, 18" vertical
18 Speeds: 30 to 1500 rpm
18 Feeds: 3/16" to 32"

VAN NORMAN MACHINE TOOL CO., SPRINGFIELD,

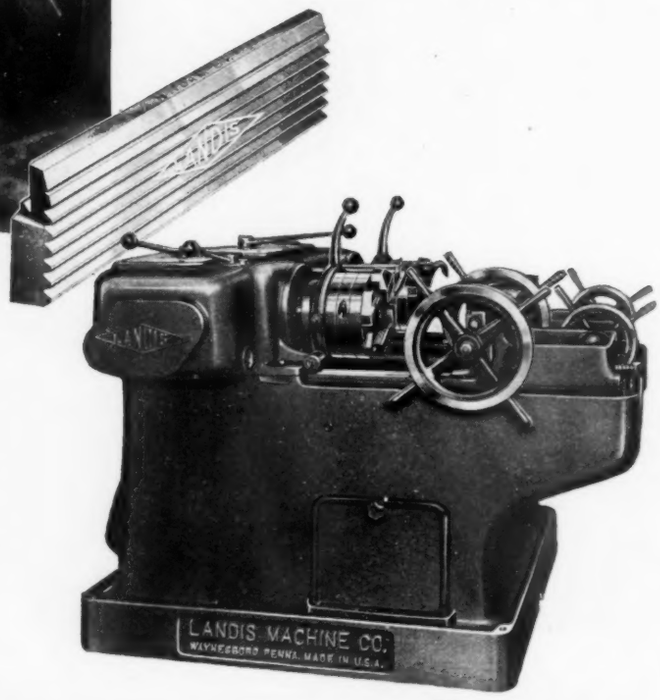


MASSACHUSETTS

VAN NORMAN
Milling Machines

★ In WAR as in PEACE

LANDIS
Leads
In
Quality
Accuracy
Performance



For 40 years Landis has maintained a standard of quality, accuracy and performance accepted by industry throughout the world. Today LANDMACO Threading Machines, Die Heads and Chasers are daily setting performance records in cutting—with precision accuracy—the countless threads employed in the assembly and operation of Diesel Engines, Aircraft, Ships, Tanks, Guns and other implements of war.

Write for Bulletin No. H 75 descriptive of the LANDMACO Threading Machine

LANDIS MACHINE CO.
WAYNESBORO, PENNA.

LANDIS

LANDMACO *Sets the* PACE

Manufacturers of Anti-Aircraft and other types of shells easily maintain unusually high production schedules by employing the LANDMACO Shell Tapper for tapping the nose end—to the close tolerances established—of these vital components of our war effort.

Write for Bulletin
"Be Threadwise
LANDI*Size*"

THE TOOLS YOU BUY AGAIN

Twist Drills — Milling Cutters — Reamers — Hobs — Slitting Saws — End Mills — Taps — Dies — Screw Plates — Profile Cutters.

BUY UNION TOOLS ON FAITH
...and you'll use them for RESULTS

You can come to UNION for your small tools on faith in the organization behind them. Once you've put them to work you'll find full justification for your confidence. Consistently fine performance in terms of better, faster work at lower cost is your reward for taking our word and the word of countless users for the fact that UNION sets high standards for quality and results.

UNION has maintained its leadership in small tools over a period of many years—tools that are recognized everywhere for uniformity, dependability and long-lived productivity—tools that give faithful, economical performance. Prove them by using them.

UNION TWIST DRILL CO.
Athol, Mass.

STORES New York Store: 61 Reade St.; Los Angeles Store: 524 East Fourth St.; Chicago Store: 11 So. Clinton St.; Seattle Store: 568 First Ave., So.; San Francisco Store: 121 Second St.; Detroit Store: 6540 Antoine St.

MANUFACTURING DIVISIONS

S. W. Card Mfg. Co., Div.; Mansfield, Mass.
Butterfield Division, Derby Line, Vt., and Rock Island, Quebec
Representatives throughout the world

UNION

MID-WEST ABRASIVES *Nearly Doubled* THIS MANUFACTURER'S STRUT PRODUCTION!

Is Faulty Honing Retarding Your Production?

The XYZ Corporation, building chrome molybdenum landing gear shock struts for Uncle Sam, had their hands full of honing trouble — until they switched to MID-WEST abrasives. Now the struts are honed to a finish far in excess of inspection limitations and, what is more important, production of the struts has been almost doubled.

XYZ engineers were using one stone for roughing and another for finishing, which was perfectly all right except for the fact the finishing stone was generating too much heat and causing distortion of the work. At times this distortion was being carried to a point where the cylinders were .005″ out of round whereas the inspection limit was .001″.

A MID-WEST sales-engineer was consulted and, at the company's invitation, he experimented with stones of various hardness and grain structure. As a result of these tests he recommended the use of MID-WEST 500-48X stones for both roughing and finishing, it being proven that the stone removed stock rapidly and created a smooth finish as well.

During actual production use subsequently the MID-WEST 500-48X stone, operating on thin-walled tubes, has removed stock quickly, held the bores to within .0002″ in both roundness and taper, and done so without generating heat and without danger of distortion. The additional speed of this stone, plus the fact the honing is now done in one operation instead of two, has enabled the corporation to increase production to a point where it has almost doubled.

The adoption of MID-WEST abrasives banished a lot of honing headaches for XYZ engineers. They can do as much for you. Our engineers, located in all large cities, will be glad to cooperate with you.

MID-WEST ABRASIVE COMPANY

Manufacturers of DEPENDABLE Abrasives

1960 E. MILWAUKEE AVENUE — DETROIT, MICHIGAN

Mid-West

- ★ *Honing Stones*
- ★ *Superfinishing Stones*
- ★ *Grinding Wheels*
- ★ *Emery Cloth*
- ★ *Sandpaper*

Mid-West Abrasive Company,
1960 E. Milwaukee Avenue,
Detroit, Michigan

Gentlemen: Please send me additional information on Mid-West Micro Bond honing and superfinishing stones.

Name _____

Company _____

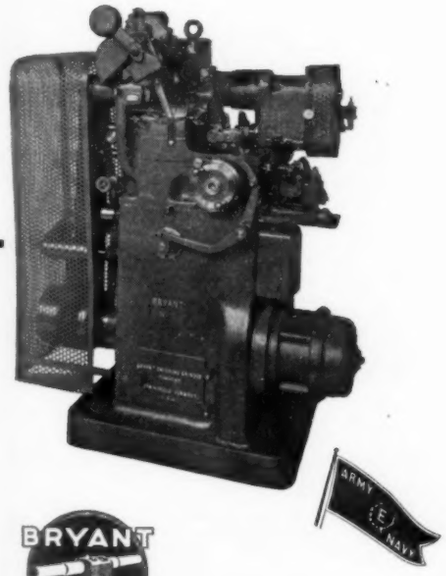
Address _____

_____

So Long as There is War...

So long as there is war, every resource of this country—in men, management, materials and machinery—is dedicated to the common cause . . . and because this effort is nationwide, united and unstinting, something important is happening to the peacetime future of our world.

Not only is this war creating a vast new reservoir of production; a pooling of knowledge, skills and new techniques; a more plentiful supply of materials. It is building up a new consumer's market; creating a demand for millions of war-restricted articles; creating future competition with new, improved products; building a backlog of savings created by war bonds and consumer shortages.



BRYANT

As Soon as There is Peace

As soon as there is peace, men, management and materials will return to profitable commerce. And with this country in a strategic position to maintain a long epoch of peace and prosperity, there are many business leaders who discern tremendous opportunities in tomorrow's markets.

Far-sighted companies are already designing new products, scanning new outlets, perfecting new plans for cutting their costs with versatile, rapid, improved machine tools. To such management, this is an invitation to write today to Bryant. Send us your internal grinding problems, and take advantage of the work which our engineers can do *now* to help you formulate production plans and open new markets for the peaceful years ahead.

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

Send for the Man from Bryant

LEES-BRADNER★ Thread Millers

MODEL LT
LIGHT
TYPE

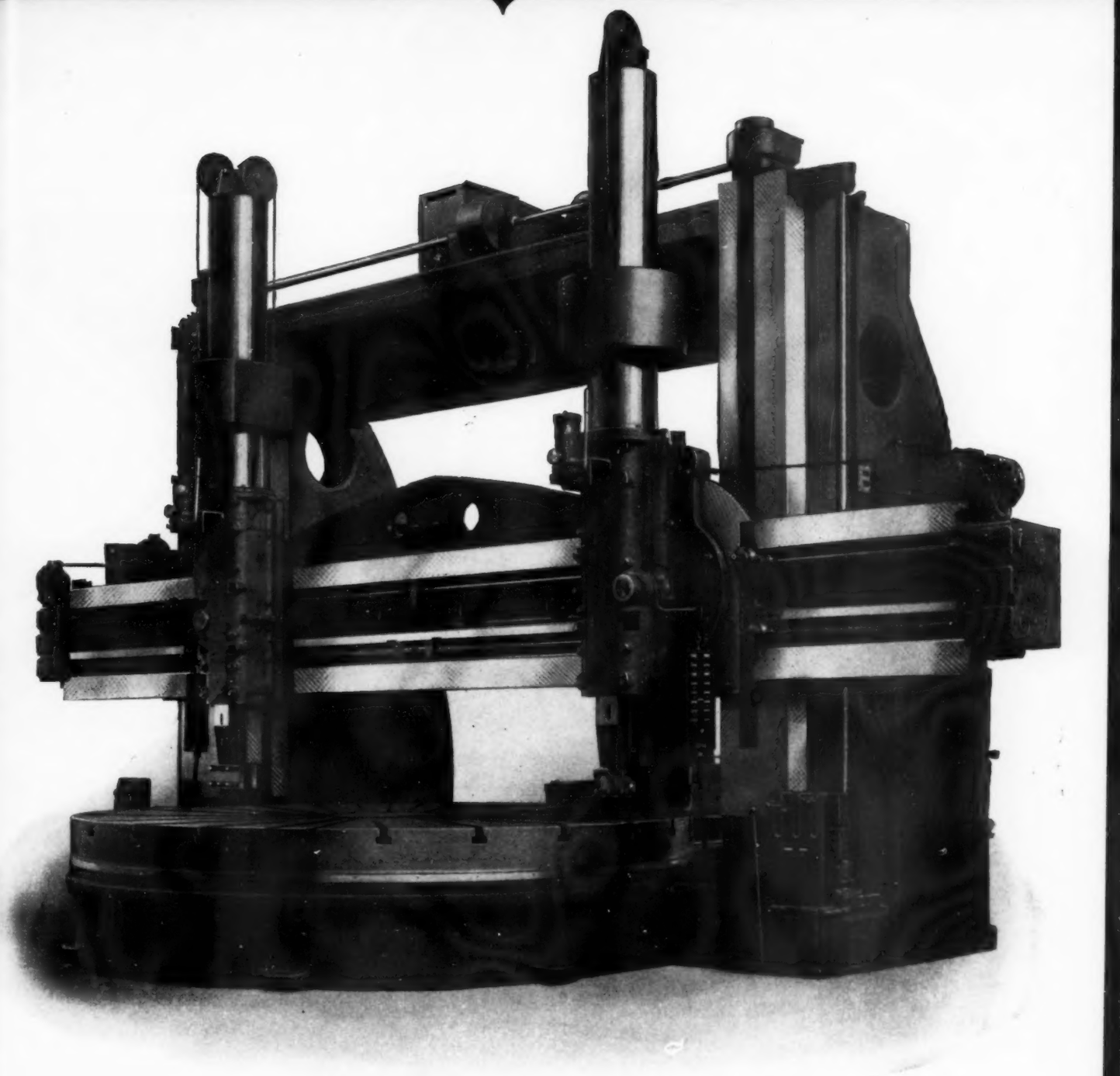
ARE EARNING THEIR WINGS IN THE AIRCRAFT INDUSTRY

The many LT Thread Millers working around the clock in countless airplane plants is ample proof of the dependable accuracy and high production these plants expect . . . and get from Lees-Bradner Thread Millers. The Model LT is suitable for either disc or hob type threading on work up to six inches diameter. Available in several lengths . . . rated capacity of 1" circular pitch.

The LEES-BRADNER Company

CLEVELAND. OHIO. U.S.A.

★ BETTS VERTICAL BORING AND TURNING MILLS ★ ★



We are building at present a number of 14 ft. and 16 ft. Betts Boring Mills similar in all respects to the machine shown above. These are all on Government orders and are allocated for shipment to industrial plants in accordance with the most urgent requirements.

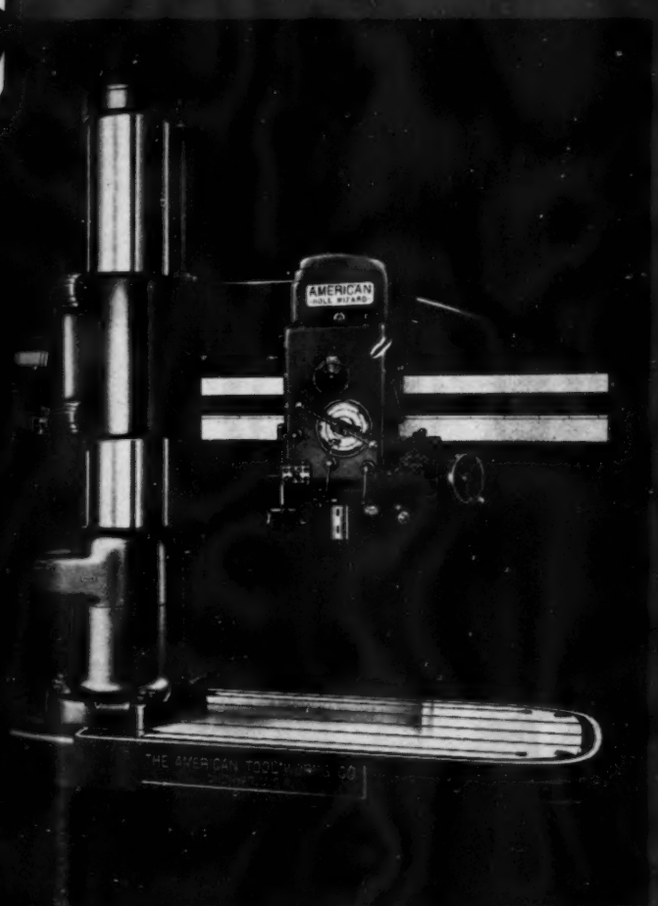
Many new and exclusive features make them outstanding for the tremendous jobs imposed by our War Program. Operation of these Boring Mills has been simplified. Electrical controls are grouped in portable push button stations, one on each side of the machine. These control stations are shown above, suspended from each head. The machine shown above will swing work 14 ft. in diameter.

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER, NEW YORK

ARMY
E
NAVY
AMERICAN
Pacemaker

"American" RECOGNITION



For years "AMERICAN" Lathes, Radials and Shapers have been recognized in countless shops throughout the nation for their high production, accuracy and low cost operation.

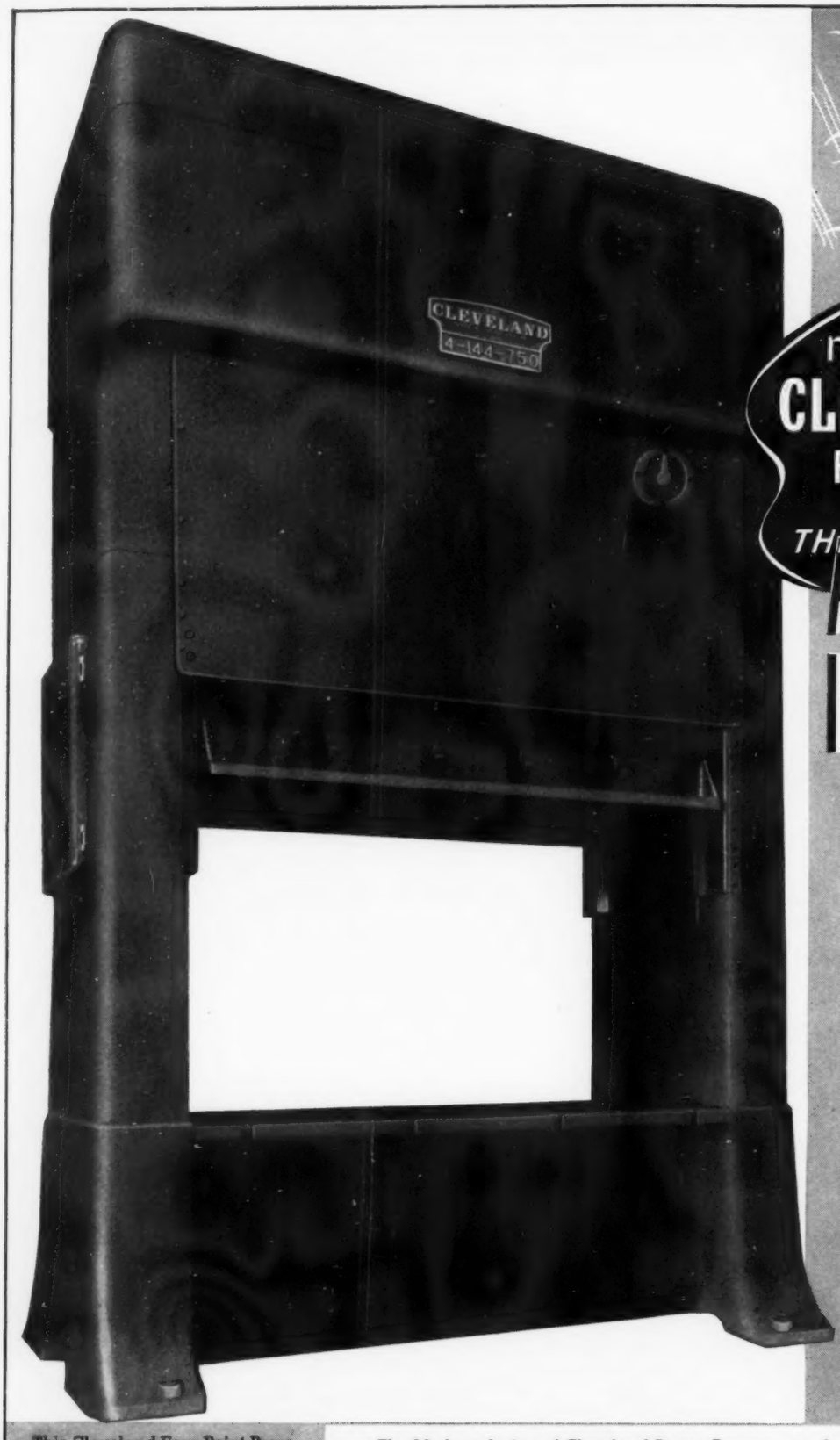
Today "AMERICANS" receive national recognition for an outstanding production job well done. Today the Army and Navy "E" Pennant is waving over the "AMERICAN" plant as a symbol of excellence in the production of vital War equipment.

Tomorrow and for years to come the name "AMERICAN" will signify the utmost in modern design—dependable accuracy—and economical production

THE AMERICAN TOOL WORKS CO.
CINCINNATI, OHIO

★

LATHES
RADIALS
SHAPERS

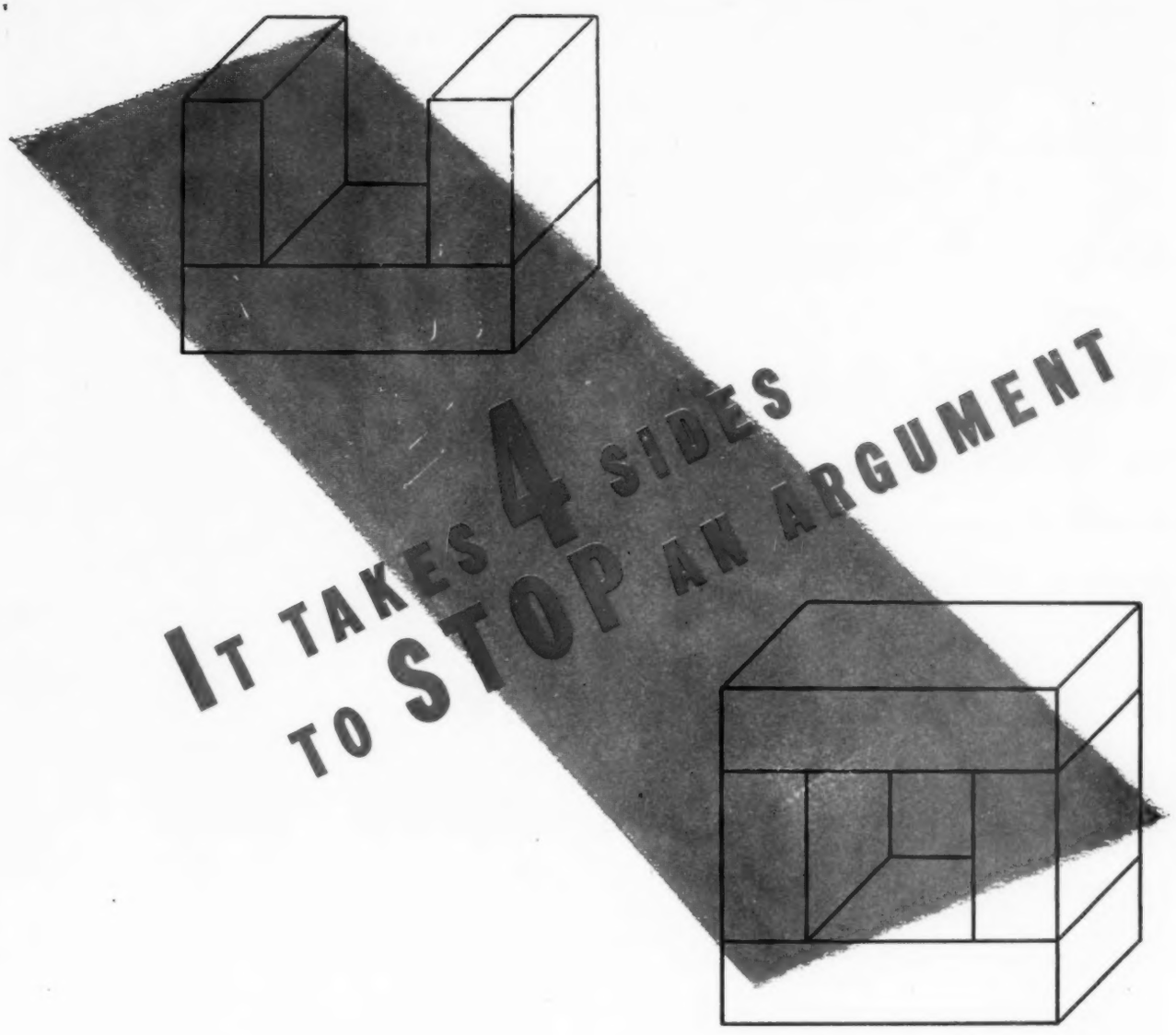


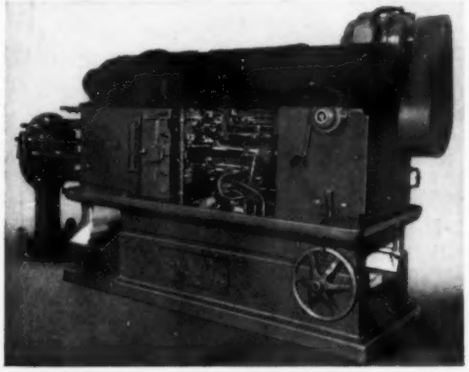
MODERN CLEVELAND PRESSES for THE AVIATION INDUSTRY

This Cleveland Four Point Press, which has a bed area of 80" x 144" and a capacity of 750 tons, is well adapted for fast and accurate production of airplane parts.

The Modern design of Cleveland Power Presses, coupled with their extremely massive and rugged construction, permits the forming of airplane parts to exceptionally close tolerances and, in addition to the important features of low initial cost, high production, minimum upkeep and dependability, there is the added advantage, that men can be trained to become efficient operators of Modern Cleveland Presses in a comparatively short space of time.

Modern Presses · THE CLEVELAND PUNCH & SHEAR WORKS COMPANY · *Cleveland, Ohio*





The green portion highlights an outstanding feature of Conomatic design —the cam shaft in the rugged top bed.

It takes four sides to stop the argument concerning accuracy and rigidity of multiple-spindle automatics.

Conomatic design includes a heavy, rugged top bed that completes the all 'round support of the work area — *four sides of* heavy, rugged support for accuracy, rigidity and durability.

***All Conomatics* are readily identified by the overhead cam shaft in the top bed. This construction has a triple advantage — it strengthens the mounting of spindles, auxiliaries, slides and tools — it puts the cams overhead away from coolant, dirt and chips — it affords easy accessibility, resulting in quick changeovers.**

CONE
AUTOMATIC MACHINE COMPANY INC.
WINDSOR, VT., U.S.A.

Wright Aeronautical Photograph

SUPERCHARGER GEARS

for the CYCLONE 9 Engine in the Grumman MARTLET 1 Fighter are cut on...

BARBER-COLMAN HOBBING MACHINES

PART AND PRODUCTION DATA

Part — Supercharger Intermediate Gear for Wright Cyclone 9 Engine.

Material — AMS 6250 Steel, a tough material.

Dimensions — 5.869" O.D., ¾" face, 57 teeth, 10-12 pitch.

Machine Set-up — Hob speed, 91 r.p.m.; feed, .043" per rev. of work.

Production — 27 min. per piece, floor-to-floor; one piece per load. One finishing cut.

Hob — 2½"x2½"x1¼" straight hole, ground, single thread; 3 to 4 settings per sharpening and 12 pieces per setting.

Because every precaution must be taken to insure accuracy in engines for the highly efficient fighting aircraft of modern warfare, the blank for this supercharger gear is held in the hobbing machine on a special work arbor which accurately locates the piece from its finished ground hubs. Before cutting, the blank is trued to an eccentricity of less than .0003". Also, the special arbor supports the blank rigidly on the sides close to the teeth, to avoid any chance of vibration spoiling the fine finish and accuracy required. A Barber-Colman Type "A" Hobbing Machine is used because its rugged construction, combined with the special work-holding device, insures consistent production of high quality work.

This is one of many applications where Barber-Colman Hobbing Machines are doing their part in producing important parts for vital weapons. All of Barber-Colman's machine production is directed into the war effort.

BARBER B-C COLMAN PRODUCTS
HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

BARBER-COLMAN COMPANY

General Offices and Plant 201 Loomis Street, Rockford, Illinois, U. S. A.

A roll call of shops producing implements of war would find many Potter & Johnston Automatic Chucking Machines turning out accurate duplicate parts and maintaining high production hour after hour, day and night.

And day and night the great Potter & Johnston plant is rushing the building of more and more machines to reinforce those already handling war production.

Every day sees parts in greatly increasing quantities being produced to exacting specifications on P&J Automatic Chucking Equipment—for airplanes, airplane engines, machine guns, anti-aircraft guns, the Bofors gun, the American Oerlikon gun and other emergency needs.

P&J was ready, by long specialized experience, proved equipment and versatility in tooling to meet the demands of vastly stepped-up production.

The POTTER & JOHNSTON MACHINE CO.
PAWTUCKET . . . . . RHODE ISLAND

HERE'S A WAY TO SEPARATE Your TOOL STEEL SCRAP!

YOU do not have to be *told* about the seriousness of the steel scrap situation. With a six-million-ton scrap shortage actually curtailing our armament production—you do not have to be told *why* we must put every pound of steel to work, *now!*

In your tool room, machine shop and the plant in general there are worn or obsolete dies, tools, jigs and fixtures that *should* be helping to make more fighting equipment for our soldiers. Dig out this precious tool steel that is the *start* of more war weapons. Then separate it. Tool steel scrap is worth more to you, and to your country, when it is properly sorted.

To help you sort your tool steel scrap for salvage, our Testing Department has developed the *Spark Testing Guide* offered on the next page. This 21" x 30" wall chart can be the starting place for your men to learn more about *Spark Testing* as a means of classifying tool steel scrap.

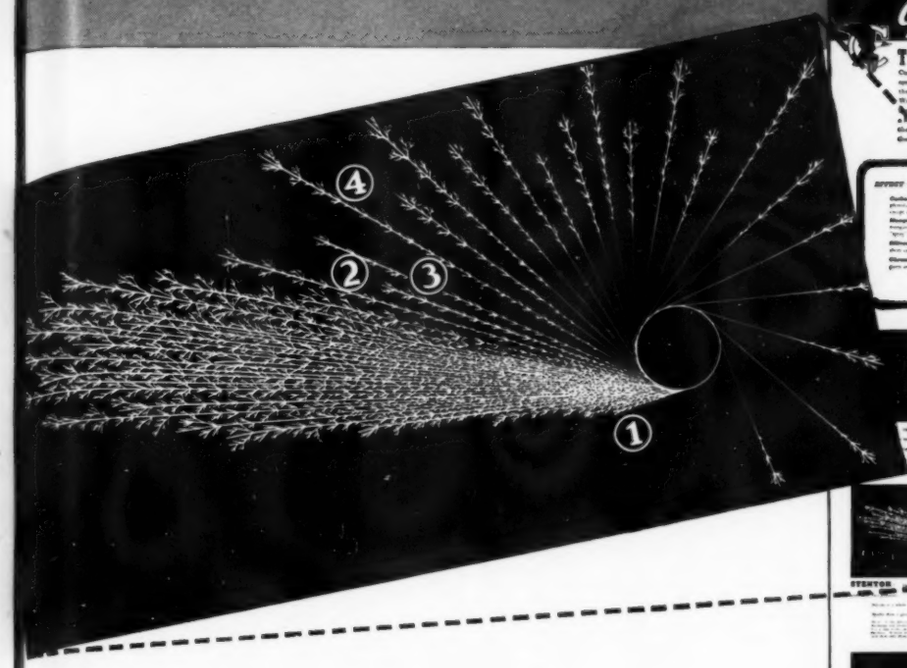
How to Use SPARK TESTING

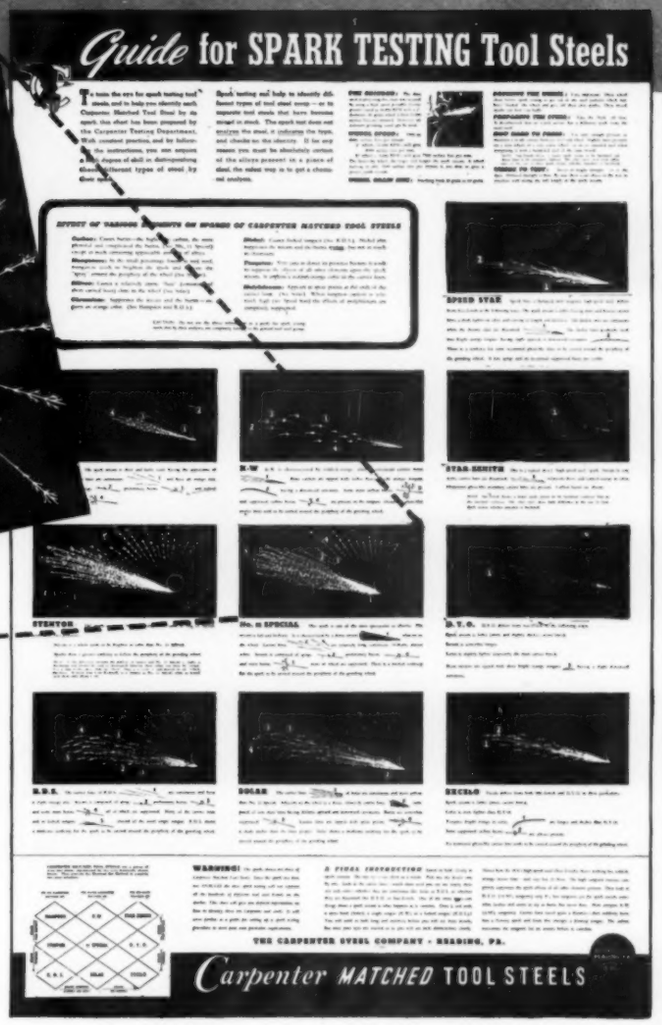
Spark Testing is a convenient way to check the identity of a piece of tool steel. It does not *analyze* the tool steel, but gives a quick indication of the major elements present. With practice, your men can learn to identify the spark patterns made by the various elements such as carbon, silicon, molybdenum, etc. (Note the sample diagram on the opposite page.)

The Standard Tool Steels of Industry

SPARK TESTING TOOL STEELS

- to separate tool steel scrap, broken tools, worn dies, etc.
- to classify tool steel that has lost its identity in stock.





SPARK TEST for No. 11 SPECIAL Straight Carbon Tool Steel

This spark is one of the most spectacular to observe. The stream is full and brilliant. It is characterized by a dense stream (1) adjacent to the wheel. Carrier lines (2) are relatively long, continuous, brilliant, *almost white.* Stream is composed of sprigs (3), preliminary bursts (4) and main bursts (5)—none of them suppressed. There is a marked tendency for the spark to be carried around the periphery of the wheel.

IN TOOL ROOMS, many hours and precious pounds of metal are saved when tools are always made from the right tool steels. Let your tool makers use the Carpenter *Spark Testing Guide* to help them classify tool steel that has lost its identity.

A note on your company letterhead will bring you this large wall chart, from which your men can learn the spark patterns caused by the major elements in tool steel. Instructions are also given for *Spark Testing;* wheel speeds, effects of wheel grain size, dressing the wheel and pressure required. Write today for your *Guide for Spark Testing Tool Steels.*

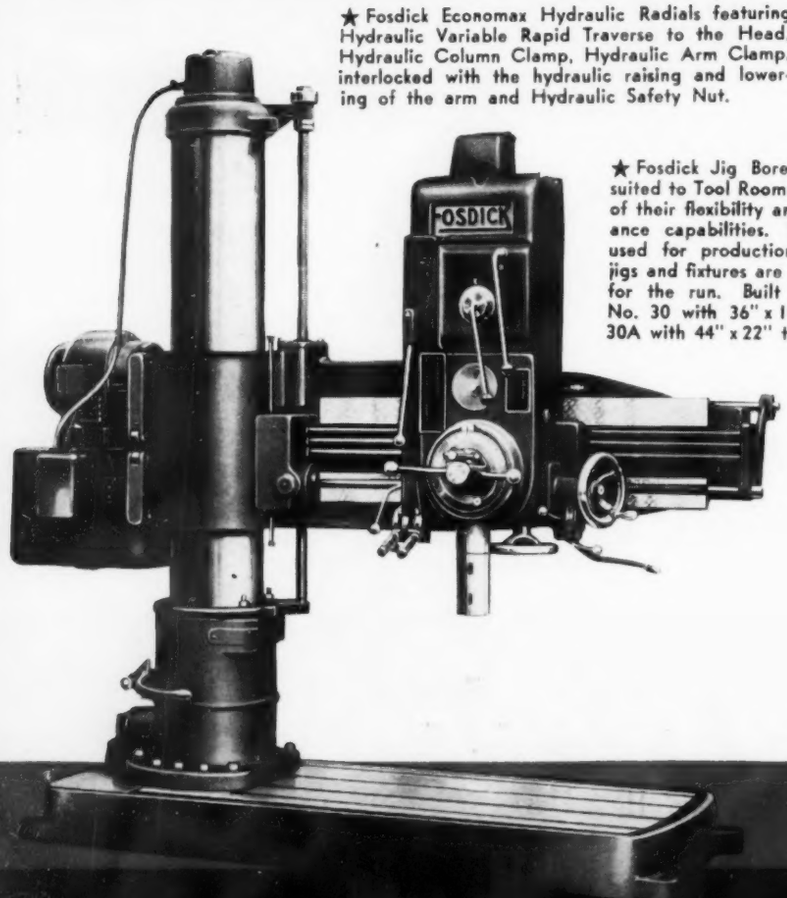
THE CARPENTER STEEL COMPANY, 109 BERN STREET, READING, PA.

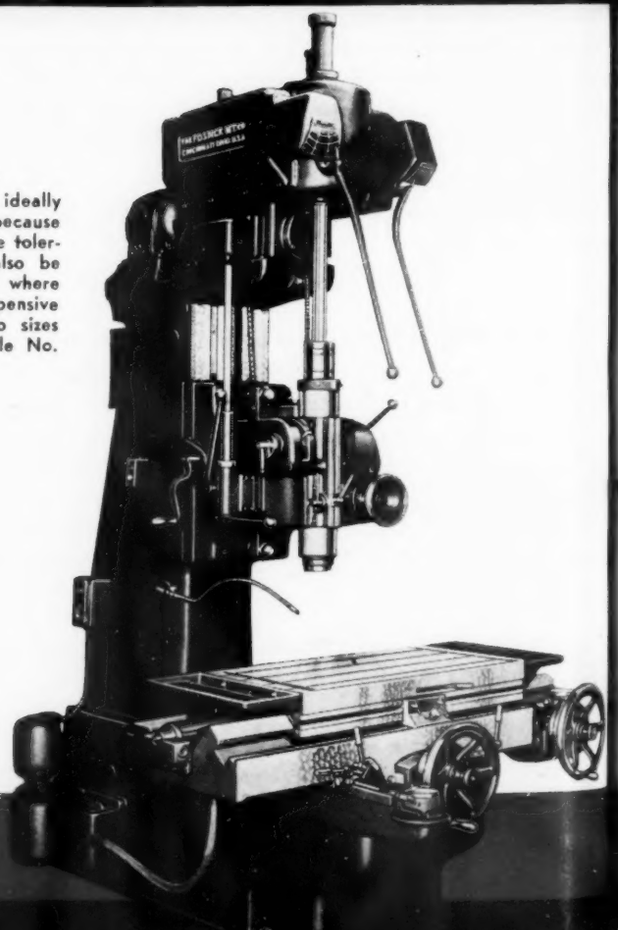
Carpenter MATCHED TOOL STEELS

BRANCHES AT Chicago, Cleveland, Detroit, Hartford, St. Louis, Indianapolis, New York, Philadelphia

★ Fosdick Economax Hydraulic Radials featuring Hydraulic Variable Rapid Traverse to the Head, Hydraulic Column Clamp, Hydraulic Arm Clamp, interlocked with the hydraulic raising and lowering of the arm and Hydraulic Safety Nut.

★ Fosdick Jig Borers are ideally suited to Tool Room work because of their flexibility and close tolerance capabilities. May also be used for production work where jigs and fixtures are too expensive for the run. Built in two sizes No. 30 with 36" x 18" table No. 30A with 44" x 22" table.

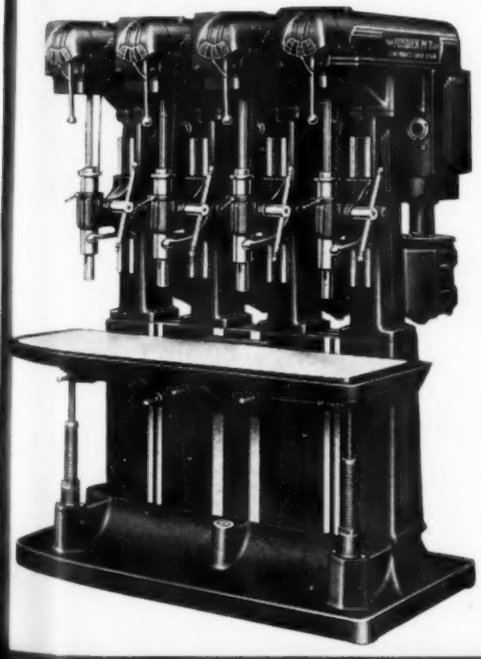




E NAVY

ARMY-NAVY AWARD

Fosdick 4-BM & 5-BM Sensitive Drills with indi-ual motor for each spindle. Capacity from er drills to 1½"—Spindle speeds from zero 12,000 RPM. Illustrating a 4-spindle unit—also ilable in single—two and three spindles.



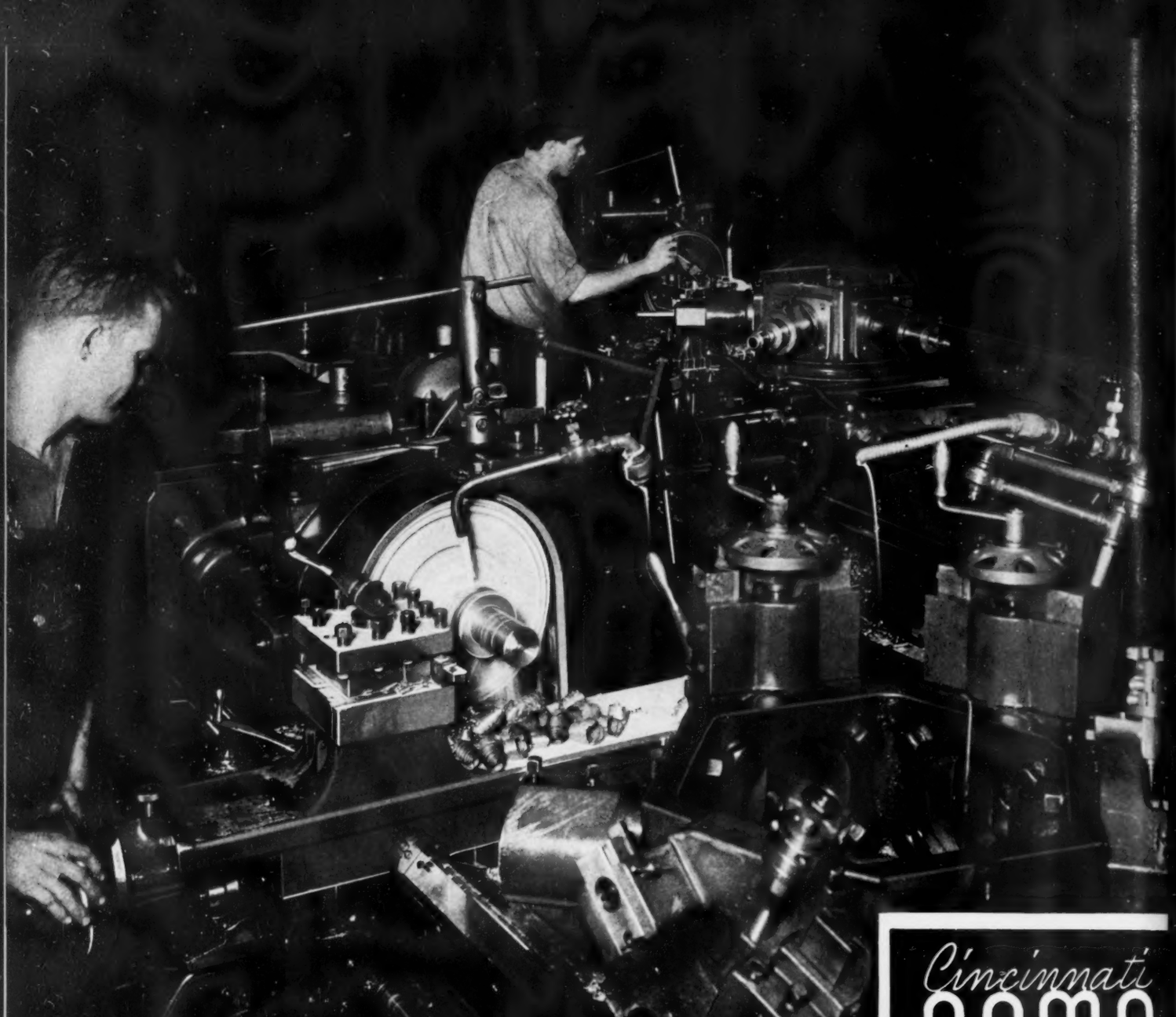
★ As a token of excellence in the manufacture of vital Machine Tools for the production of arms—tanks—and munitions of War—Fosdick receives the Army and Navy Award.

This Army and Navy Star symbolizes in the Fosdick organization a unity of spirit—singleness of purpose—and determination to drive on to even greater production accomplishments.

Fosdick accepts this award as a challenge to future attainment and will continue to deliver in the months to come as it has in the past until final and complete victory has been secured.

FOSDICK MACHINE TOOL CO.

CINCINNATI · OHIO



Cincinnati
ACME
UNIVERSAL
TURRET LATHES

26% TIME SAVED FOR CINCINNATI PLANER!

The two CINCINNATI ACME Universal Turret Lathes shown above are in the plant of the Cincinnati Planer Co. The one in the foreground is rough turning bevel gears, and doing the job, according to Cincinnati Planer's records, at an average time saving of 26%. The machine is a No. 3S CINCINNATI ACME Universal Turret Lathe having a 4½" bar capacity with a 26½" swing over vees, 24½" over carriage wings and 18½" over bridge of cross-slide.

Design features that assure an abundance of power and rigidity for carbide tool cutting and wide feed and speed ranges for fast, productive cutting, are the qualities that give CINCINNATI ACME Universal Turret Lathes the ability to meet current production demands profitably, accurately and efficiently.

Write for Bulletin G-102 for a full description or consult our engineering staff on any problem of turret lathe production.

THE ACME MACHINE TOOL CO.,
...CINCINNATI, OHIO.

A LEADER in the Industry for More than 54 YEARS!

KEMPSMITH

KEMPSMITH MACHINE CO. • MILWAUKEE, WISCONSIN, U. S. A.

PRECISION BUILT MILLING MACHINES SINCE 1888

INDUSTRY'S

T-16

TUNGSTEN-TITANIUM CARBIDE

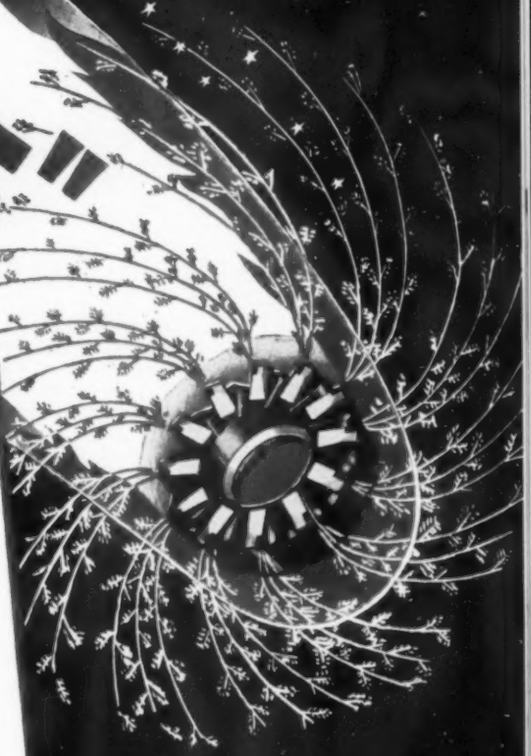
TITANIUM is responsible for Firthite T-16's brilliant record in the light, rapid finishing of high-strength steels used in aircraft, tanks, and other mechanized equipment and materiel.

Inclusion of **TITANIUM** in the composition of ALL Firthite steel-cutting grades has stepped up the speed, improved the finish and accuracy of the work, increased the number of pieces between grinds.

TITANIUM is very plentiful and inexpensive. Firthite tips containing this amazing ingredient are now priced lower than ever before, because greater demand and volume production have made possible lower processing costs.

In addition to the steel-cutting grades (T-16, TA, and T-04—all with Titanium), **FIRTHITE** is made in Grades HA, H, and HC for speedy machining of cast iron, non-ferrous metals, and non-metallic compositions.

"BALL OF FIRE"



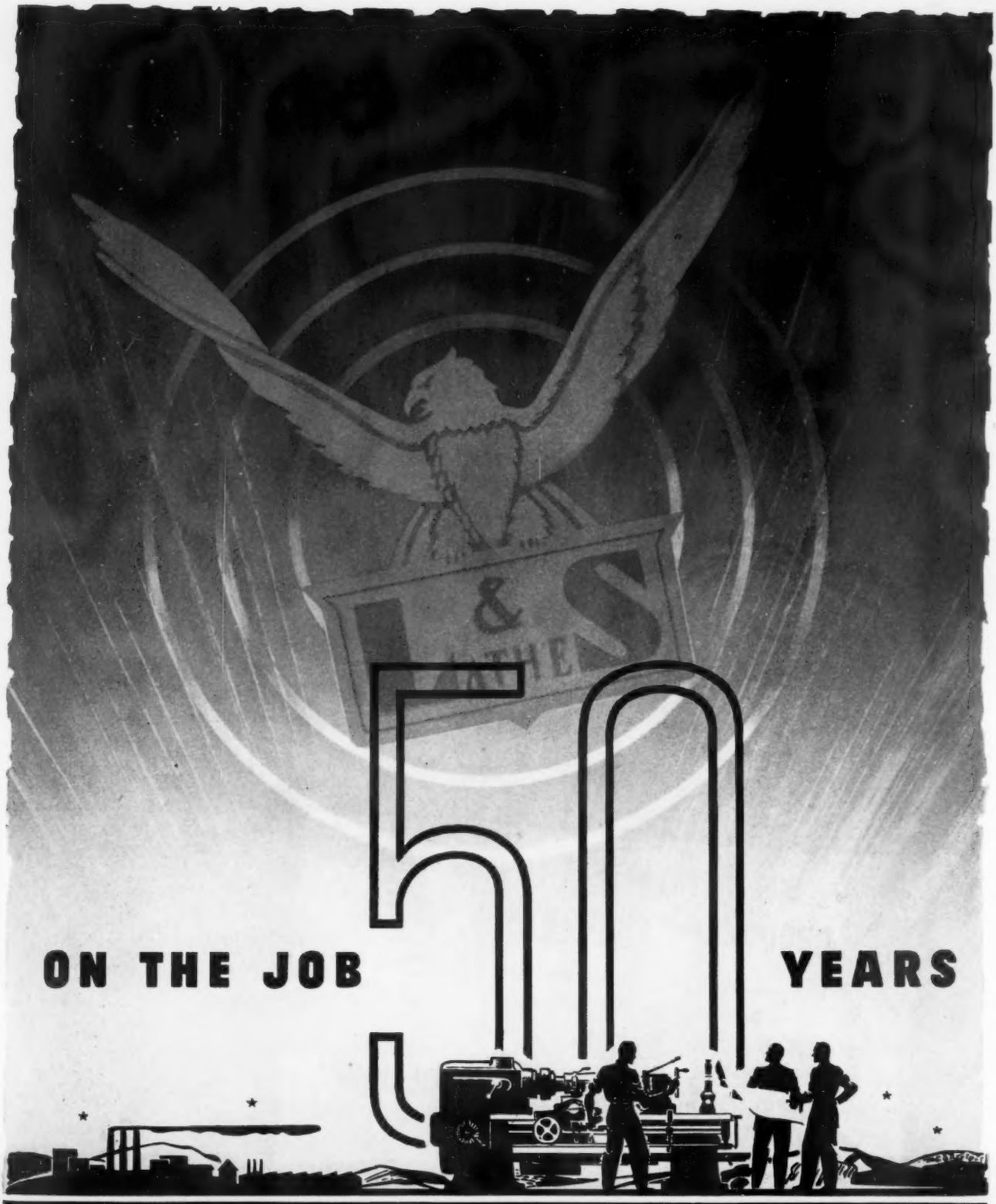
WITH FIRTHITE T-16 YOU CAN PRODUCE—"ENOUGH—ON TIME!"

1. **THE** grade for fine, exceptionally fast facing, boring, and turning to close limits where sustained accuracy is essential.
2. **THE** grade for producing smooth, highly burnished surface on work.
3. **THE GRADE FOR "HYPER-MILLING"** (see Firthite Engineering Bulletin No. FE-106 on this new process).
4. **THE** grade for use on modern, high-speed, high-powered, rigid machines.
5. **THE hardest** standard steel-cutting grade . . . best "wear-resister" for finishing hardest, heat-treated alloy steels.

Firth-Sterling

STEEL COMPANY

OFFICES McKEESPORT, PA. NEW YORK HARTFORD LOS ANGELES CLEVELAND CHICAGO PHILADELPHIA DAYTON DETROIT

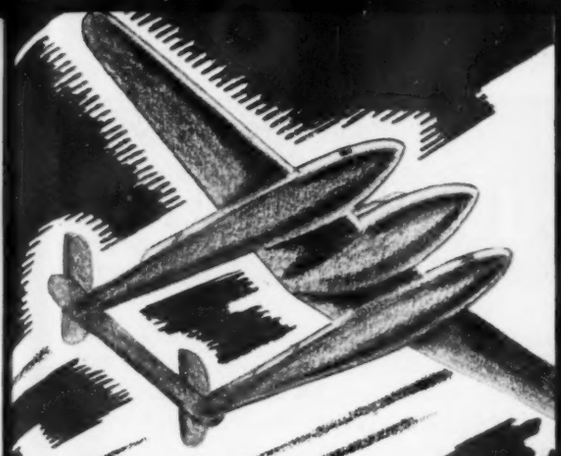


Lathes, Good Lathes Only

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.

ENGINE TOOL ROOM AUTOMATIC LATHES



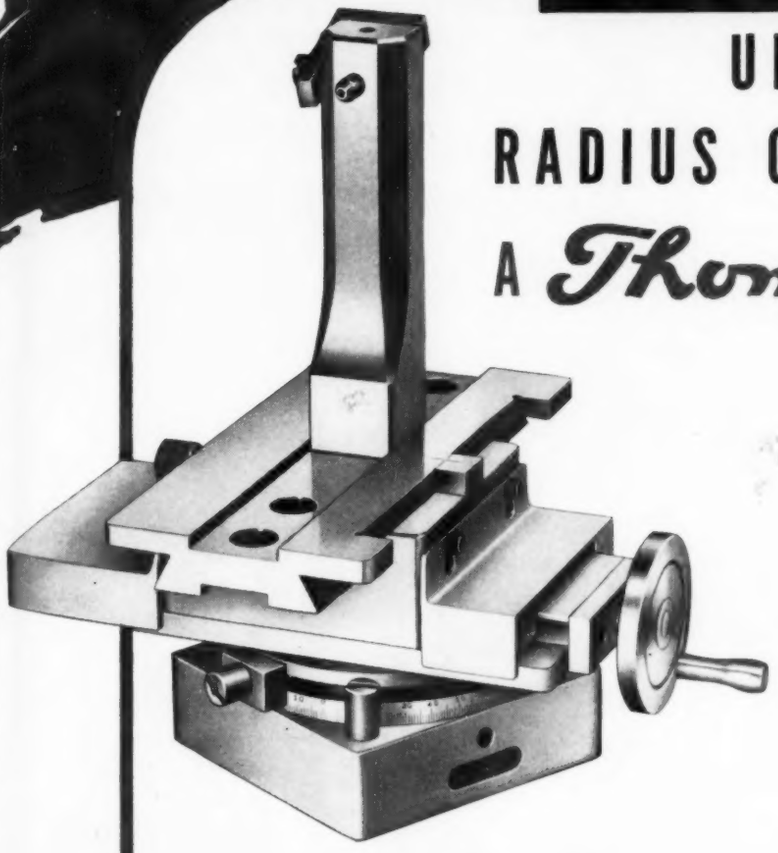
A
FLEXIBLE NEW TOOL
TO SPEED

Vital

PRODUCTION

UNIVERSAL RADIUS GRINDING DRESSER

A *Thompson* · PRODUCT



PATENT PENDING

This Dresser will dress a radius on a wheel either concave or convex from 30 thousandths to 4 inches and do same accurately and efficiently.

The Dresser is set by gauge blocks eliminating any guess work.

It will also dress any angles required on a wheel.

Also can be set for a radius and angle without changing the set up.

TRADE MARK
Thompson
REG. U.S. PAT. OFF.

AUTO-ORDNANCE *Corporation*

THOMPSON TOOL DIVISION

[illegible] WEST PUTNAM AVENUE GREENWICH, CONN.

Micromatic Anticipates Future

1. Micromatic work holding fixtures assure MAXIMUM EFFICIENCY in GENERATING FINAL SIZE, GEOMETRIC ACCURACY, SURFACE QUALITY and SURFACE FINISH.

2. Micromatic Manually Controlled Hutto-hones fulfill lower production needs with minimized equipment for any amount of stock removal desired.

3. Micromatic Automatically Controlled Microhones are specific purpose tools, for stock removal usually not exceeding .003″ to .004″.

4. Micromatic Hydraulically Controlled Drawfinishing Tools generate final finish with all markings co-directional with the axis of the bore.

5. Micromatic Hydraulically Controlled Tubing Hones remove from .001″ to .075″ stock in bores up to 30″ diameter x 75 feet long — generate accuracy within .0005″ to .001″.

6. Micromatic Hydraulically Controlled Hydrohones (with or without remote control) remove from .001″ stock upwards in tubing and large diesel liners — generate accuracy within .001″.

7. Micromatic Model 100 Hydrohoner with Automatic Microsize Control and Loading removes up to .002″ or .003″ stock in cast iron bores from ¼″ to 1″ diameter x 6″ long — generates accuracy within .0001″ to .0002″ and size within .0005″.

8. Micromatic Model 200 Hydrohoner removes up to .003″ or .005″ stock in cast iron bores from 1″ to 2″ diameter x 6″ long — generates accuracy within .0001″ to .0003″.

9. Write for Bulletins AR-65 and AR-67.

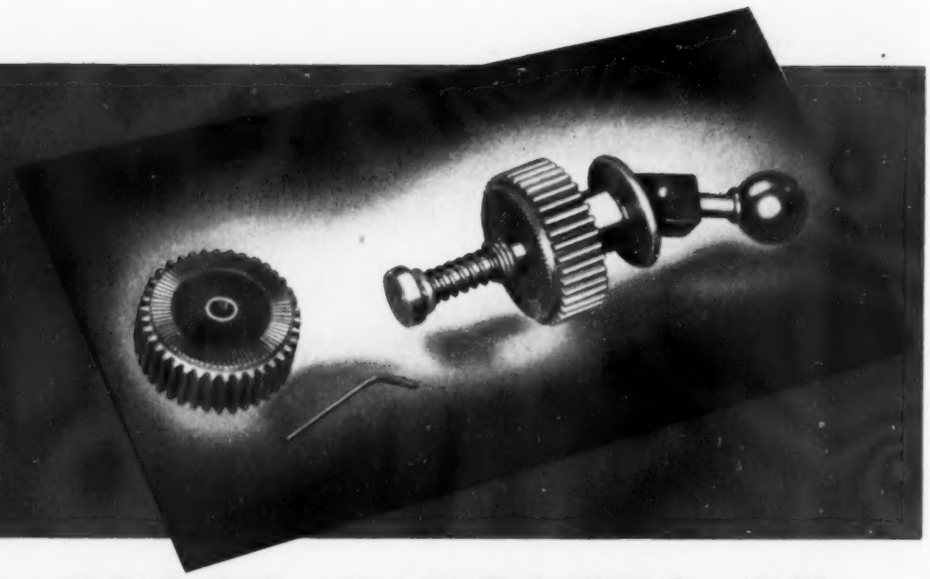
MICROMATIC HONE CORPORATION

Production Honing Needs

1345 E. Milwaukee Ave., Detroit, Mich., U. S. A.

QUICK ENGAGEMENT

GREATER PULLING STRENGTH

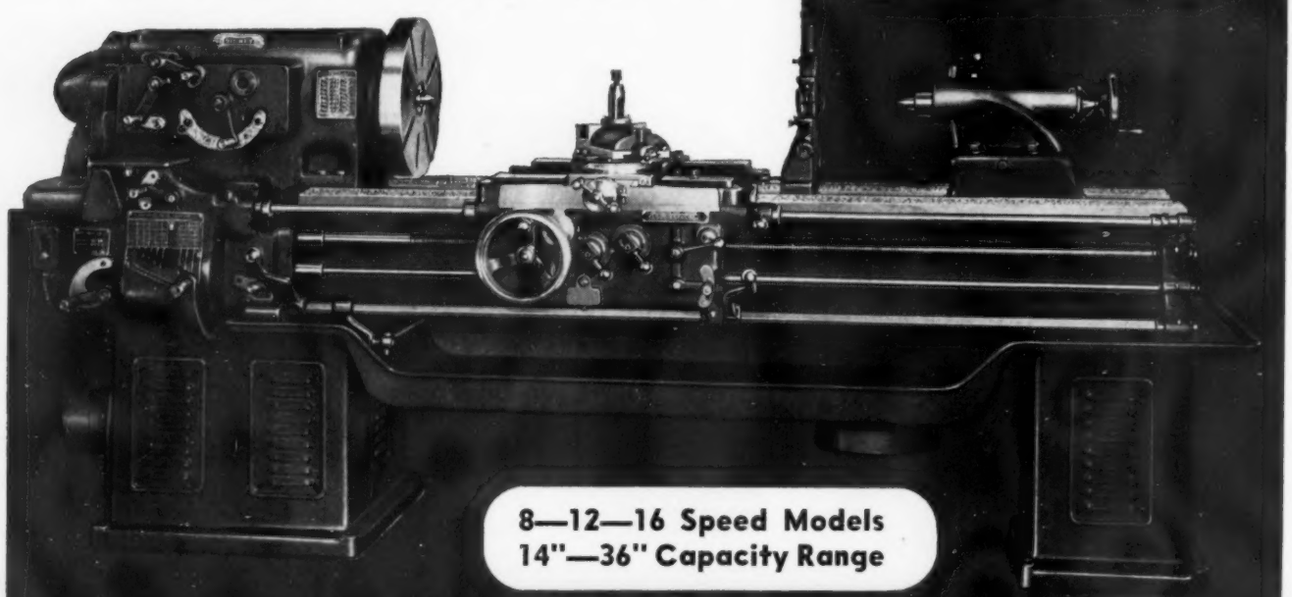


feature APRON CLUTCHES ON Sidney Lathes

Every unit contributing to the Speed and Power of Sidney Lathes is helping to step-up our War production to a point heretofore considered impossible.

The Apron Clutch illustrated is one of the advanced mechanical units incorporated in the design of Sidney Lathes. The serrated teeth are cut on entire face of engaging clutches to insure instant engagement and greater pulling power. A spring arrangement provides instantaneous release of feed, a highly desirable feature when working to close shoulder dimensions. There is also an adjustment to clutch jaws for required tension.

Complete details of all models are quickly available.



8—12—16 Speed Models
14"—36" Capacity Range

The SIDNEY MACHINE TOOL *Company*

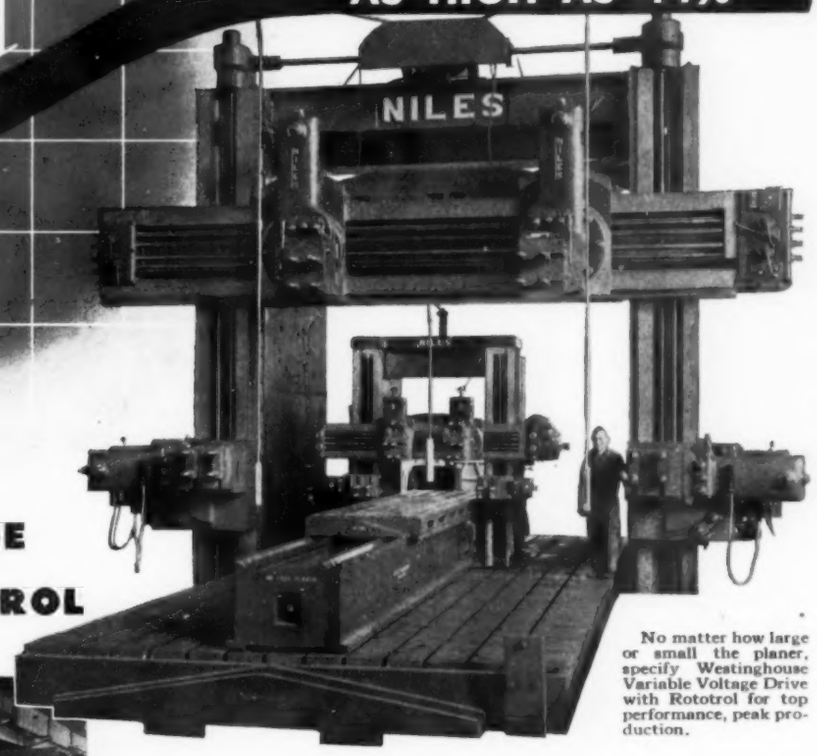
Builders of Precision Machinery

SIDNEY ESTABLISHED 1904 OHIO

PLANER PRODUCTION

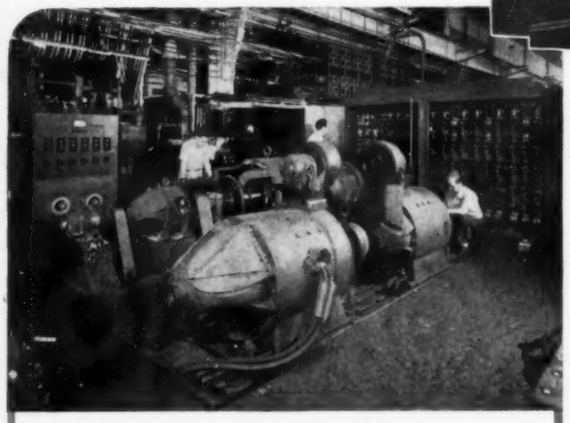
STEPS UP . . . STAYS UP

AS HIGH AS 44%



No matter how large or small the planer, specify Westinghouse Variable Voltage Drive with Rototrol for top performance, peak production.

THE NEW WESTINGHOUSE VARIABLE VOLTAGE DRIVE WITH ROTOTROL



COMPLETE DRIVE IS TESTED AS A UNIT BEFORE SHIPMENT

All equipment for the Westinghouse Variable Voltage Drive . . . induction motor, variable voltage generator exciter, Rototrol, planer motor and control panel are tested as a complete unit under simulated operating conditions at the factory before shipment.

Faster cutting strokes, faster returns, accurate stops . . . all boost planer production to new highs. Rototrol, the patented Westinghouse regulating generator, improves production speeds, isolates the drive from fluctuations of the a-c power supply. Even when the cutting load changes, the speed of the table remains the same. The table stops and reverses at precisely the same spot on every stroke, permitting planing up to shoulders and in blind pockets on precision work as well as on rough bedplate work.

Speed ranges of 30 to 1 and higher allow the most economical cutting and return speeds to be set in order to take full advantage of the long life and superior performance of newly developed tool steels.

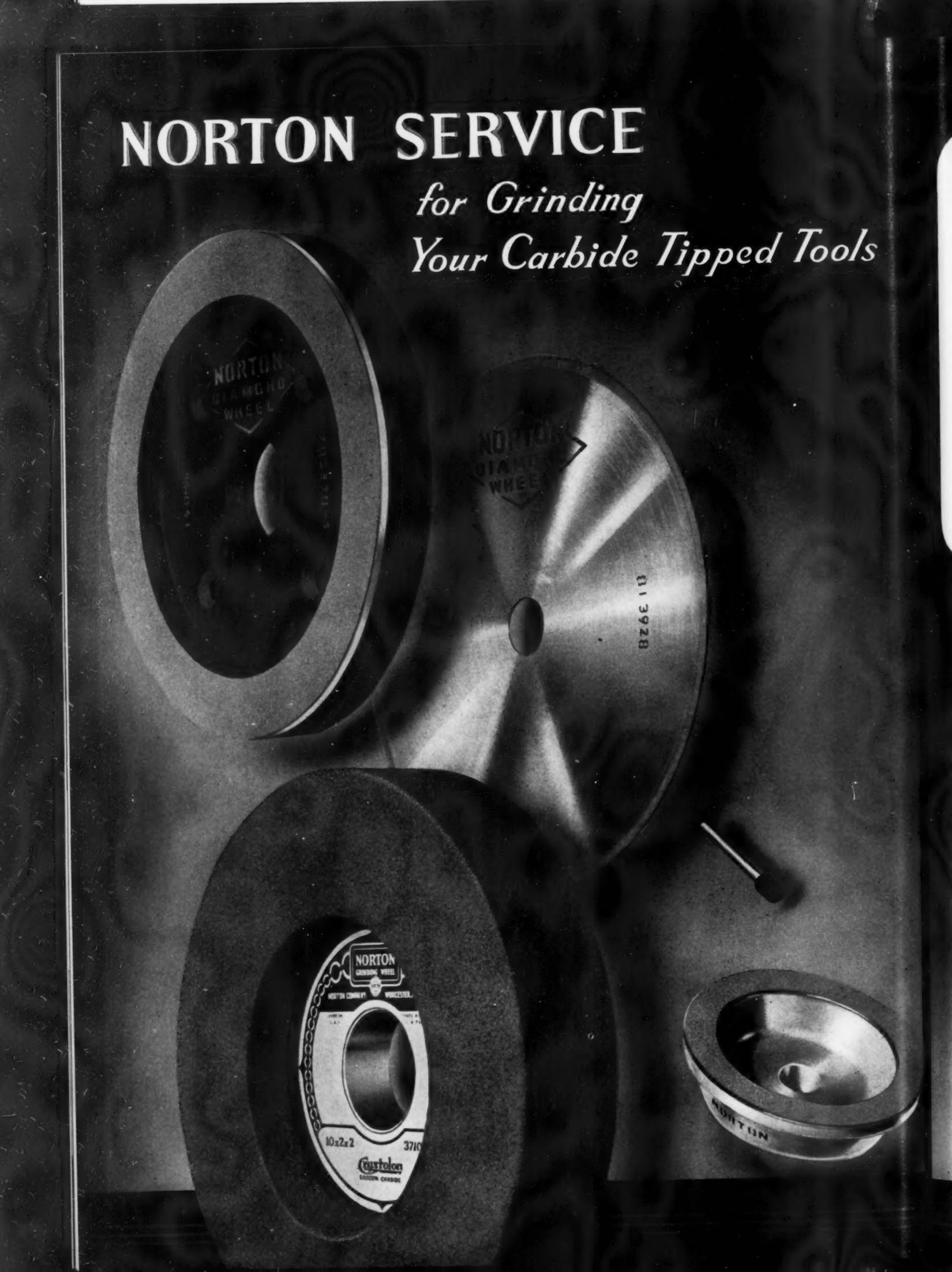
Fewer contactors, relays and interlocks are required with Rototrol. And these parts operate fewer times per cycle. Result: Wear is reduced proportionately . . . time-outs for maintenance and repairs are cut down.

Ask your Westinghouse representative for all the facts. Or write for B-3064, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N. J-21246

Westinghouse **VARIABLE VOLTAGE DRIVES**

NORTON SERVICE

for Grinding
Your Carbide Tipped Tools



There are three types of Norton wheels used for grinding the cemented carbides. Each has its field. For example: *metal bonded diamond wheels* for the off-hand grinding of single point tools; *resinoid bonded diamond wheels* for sharpening multi-blade tools such as milling cutters; *Crystolon wheels* for many roughing operations.

Norton abrasive engineers are familiar with all three types and their proper application. To obtain their help contact direct or through your Norton distributor.

NORTON COMPANY, WORCESTER, MASS.

Distributors in All Principal Cities

Grinding Wheel Recommendations
FOR CARBIDE TOOLS

Offhand Grinding (Single Point Tools)

Cup Wheels:	
Combination roughing and finishing (wet)	120 Diamond Metal Bonded
Roughing (dry)	3760/1-I7 CRYSTOLON vitrified.
Roughing (wet)	100S Diamond Metal Bonded or 100-B25 Diamond Resinoid or 3760/1-J7 CRYSTOLON vitrified.
Finishing (dry)	37100-H7 CRYSTOLON vitrified.
Finishing (wet)	220 Diamond Metal Bonded or 220-B50 Diamond Resinoid Bonded or 37100-H7 CRYSTOLON vitrified.
Straight Wheels:	
Roughing (dry)	3760/1-I7 CRYSTOLON vitrified.
Roughing (wet)	3760/1-J7 CRYSTOLON vitrified.

Machine Grinding (Single Point Tools)

Cup Wheels:	
Roughing (wet)	3760/1-I7 CRYSTOLON vitrified.
Finishing (wet)	3790/1-H7 CRYSTOLON vitrified.
Straight Wheels:	
Roughing and Finishing (wet)	3780/1-J7 CRYSTOLON vitrified.

Chip Breaker Grinding

Straight Wheels:	
Roughing and Finishing (wet)	120-B100 Diamond Resinoid Bonded.

Cutter and Reamer Grinding

Cup Wheels:	
Backing Off (Sharpening)	220-B100 Diamond Resinoid Bonded.
Straight Wheels:	
Ingersoll Cutter Grinder	120-B100 Diamond Resinoid Bonded (10 x ¼ x 1").

Surface Grinding

Straight Wheels:	
Roughing (wet)	100S or 150 Diamond Resinoid Bonded or 3760/1-J7 CRYSTOLON vitrified.
Roughing (dry)	3760/1-I7 CRYSTOLON vitrified.
Finishing (wet)	220 to 400 Diamond Resinoid Bonded, depending upon finish desired or 37100-I7 CRYSTOLON vitrified.
Finishing (dry)	37100-H7 CRYSTOLON vitrified.

Cylindrical Grinding

Roughing (wet)	100S Diamond Resinoid or 3760/1-K7 CRYSTOLON vitrified.
Finishing (wet)	100S to 400 Diamond Resinoid Bonded, depending upon finish desired, or 37100-J7 CRYSTOLON vitrified.

Internal Grinding

100 to 400 Diamond Resinoid, depending upon finish desired (available mounted on spindles in smaller sizes).

Hand Honing or Stoning

Rectangular Stick: 220 or 320 Diamond Resinoid hand hone, or 37280-N CRYSTOLON Stick.

Cutting Off

100S or 120 Diamond Metal Bonded for long life; Resinoid Bonded for fast cutting.

You'll find much helpful information in the Norton booklet "Grinding Carbide Tipped Tools"—a complete chapter on the selection and use of each type of wheel. Just ask for Form 167B.

NORTON ABRASIVES

ENROUTE *to* VICTORY

. . . Right—that's where we are heading; that's why it's important to make sure we leave no stone unturned to speed that journey. Our Avey MA-6 will maintain your high production levels. Built in No. 2 and No. 3 sizes. One to six spindle units either size—6 speed machine, 2 speed motor with three mechanical changes through gearing. Speed range—8 to 1. Push button control. (We illustrate our 3 spindle type with Avey-matic feed, hand feed, and tapper.)

Famous for their versatility, this is a Standard type Avey Drilling Machine

THE AVEY DRILLING MACHINE CO.
CINCINNATI, OHIO, U. S. A.

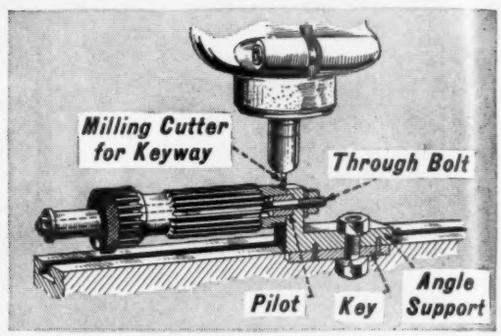
CINCINNATI · OHIO

Avey DRILLING MACHINES

SCRAP piles are much more than mere collections of trim ends, cuttings, useless machines, parts and junk these days. They're vital national resoures—*American Treasuries*, in fact, in this critical year; because the nation's steel producers will need several million more tons of scrap in 1942 than ever before, if the demands of war production are to be met. • How much can *you* contribute? Not just the usual scrap flow from your operations, but *all* the idle metal around your buildings and yards that it isn't absolutely essential to keep. Your deposit in the scrap bank will pay dividends all over the world—*make it a real one!*

Allegheny Ludlum
STEEL CORPORATION
GENERAL OFFICES: PITTSBURGH, PENNSYLVANIA

MILLING ACCURATE KEYWAYS



DEVELOPS A QUICKER WAY TO DO THE JOB

A milling department leadman in a big aeronautical plant, William Van Way, has worked out this simpler, cheaper, entirely adequate Fixture for holding hollow impeller drive shafts. Sketch shows details. Only a few simple items are needed. An angle support has a tongue, fitting in the table slot. A bushing on the vertical leg centers the shaft, which is held by a long bolt through the shaft and bushing. The depth of the milling cutter is set by a thickness gauge from top of fixture. This effective device replaces the previous expensive set-up, reduces loading and unloading time to minimum.

TIME REDUCED 50%

USING A GORTON

SUPER-SPEED VERTICAL MILLING MACHINE

with a Simpler, Faster Set-Up

MILLING ACCURATE KEYWAYS on airplane engine impeller drive shafts is done on a Gorton 9-J Miller in half the former time (6.3 minutes per piece floor to floor), holding a tolerance of ±.001″.

The keyway is .188″ wide x .440″ long, having a .020″ radius in the bottom corners. A two-flute end mill is run at 2800 r.p.m. This continuous high speed is made possible on the Gorton Super-Speed Vertical Miller because it has precision pre-loaded bearings, perfect balance, and rigid design. After each fifty pieces, the cutter is re-sharpened on the Gorton 375-2 Cutter Grinder, which not only resharpens the cutter flutes, but forms the .020″ radius as well.

This is but one of many examples of how Gorton Super-Speed Millers and Gorton Cutter Grinders save vital hours of machining in aircraft and other plants producing war equipment. Perhaps our engineers can assist you in saving additional time on your high-speed milling. We will be glad to make recommendations — no obligation.

SUPER-SPEED MILLING DATA

OPERATION—Mill Key Slot .188″ wide x .440″ long, .020″ radius in corners.

MACHINE — Gorton 9-J Super-Speed Vertical Miller.

PART—Gear Impeller Drive Shaft.

CUTTER — 2-Flute, High-Speed Steel End Mill.

HOLDING—Simple Special Fixture as illustrated.

FEED—Hand.

SPINDLE SPEED—2800 r.p.m.

FLOOR-TO-FLOOR TIME—6.3 minutes.

FREE

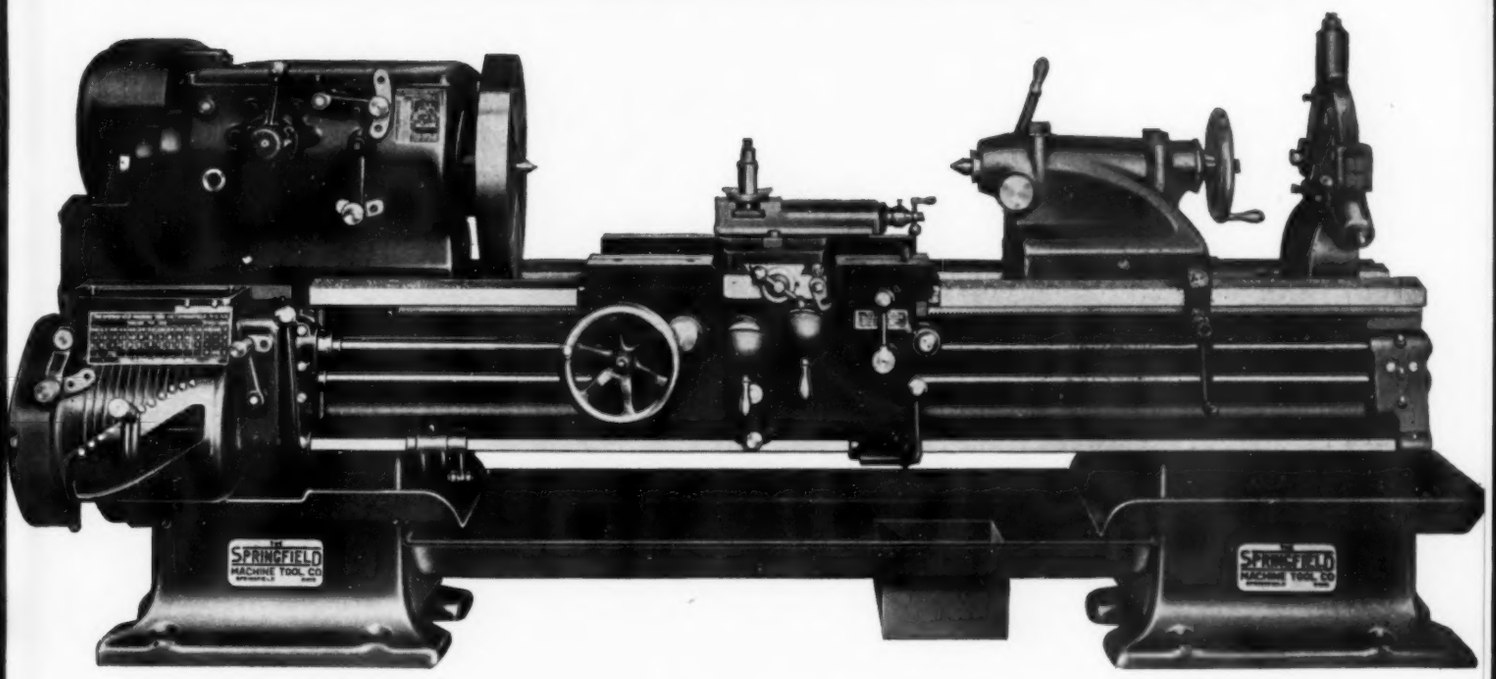
Write for your copy of Bulletin 1400-B covering Gorton Super-Speed Vertical Milling Machines. It explains their 8 exclusive advantages for handling work faster and cheaper. Used for milling dies, molds, and miscellaneous or production work.

GEORGE GORTON MACHINE CO.

1315 RACINE STREET, RACINE, WISCONSIN, U.S.A.

49 Years SPECIALISTS IN ENGRAVING, DIE MAKING AND SUPER-SPEED VERTICAL MILLING

Choose SPRINGFIELD



GEARED HEAD LATHES

• Many are the problems that face industry today, no small one being that of increasing production for war purposes. In this respect, you'll find it to your advantage to choose SPRINGFIELD Geared Head Lathes.

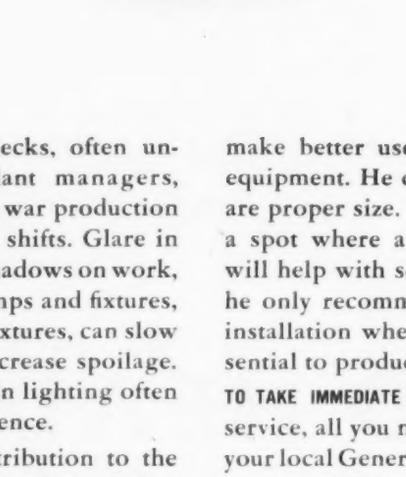
From the ground up, a SPRINGFIELD Lathe represents superior construction and design. All heavy castings, including the bed, are cast in our own shop . . . gearing is designed for maximum efficiency . . . attachments demonstrate unusual engineering ingenuity . . . lubricating systems and power transmission are built to take it, 24 hours a day. In fact, to fully understand what SPRINGFIELDS can do for you, check their superior metal turning records in other shops . . . and judge for yourself.

Under current emergency conditions, make it SPRINGFIELD Geared Head Lathes . . . *they'll do your job better, now and later, too!* Sizes range from 14" to 30." Write concerning deliveries, prices, etc.

The SPRINGFIELD MACHINE TOOL Co.

SPRINGFIELD OHIO U.S.A.

Any war plant can have this free advisory service



LIGHTING bottlenecks, often unsuspected by plant managers, may seriously impede war production—especially on night shifts. Glare in the eyes of workers, shadows on work, dirt and grease on lamps and fixtures, improper placing of fixtures, can slow up production and increase spoilage. Inexpensive changes in lighting often make a decided difference.

As a part of its contribution to the war effort, General Electric is glad to offer the services of its staff of trained lighting men—without charge—to any war factory, large or small.

THERE ARE NO STRINGS TO THIS OFFER—no obligation to buy so much as a bulb. The G-E lighting man's first job is to try to make better use of present lighting equipment. He checks to see if lamps are proper size. Occasionally he finds a spot where a supplementary light will help with some critical job. And he only recommends a new lighting installation where it is absolutely essential to production.

TO TAKE IMMEDIATE ADVANTAGE of this free service, all you need to do is this: Call your local General Electric lamp office, or your G-E lamp supplier, or write General Electric Company, Nela Park, Cleveland, Ohio. Your local power company is also ready to give you this same kind of help.

If light can work harder in your plant, now is the time to find out about it!

G-E MAZDA LAMPS

GENERAL ELECTRIC

HYDRAULIC GIANT

for Flying Fortress

CLEARING TRIPLE ACTION HYDRAULIC PRESSES WITH TRUE DOUBLE GUIDED PUNCH SLIDE FOR PRECISION FLYING FORTRESS FUSELAGE DRAW WORK.

These presses are distinguished by being arranged for every combination of pressing actions, all with fully automatic cycles. They may be adjusted to operate as single action presses for use with rubber pad, or with die cushion. They can be changed quickly and easily to act as double action presses with or without die cushion. By another easy adjustment they will give triple action operation with an upward power stroke by the third action in the bed.

Other outstanding features are: individually adjustable blankholder pressures in each set of blankholders; they are controlled from floor level; adjustable length of separation between blankholder and punch; adjustable length of stroke; pressure and speed; and safety features for making press foolproof.

Press illustrated here, 1250 ton capacity with 400 ton third action with bed area of 150" x 72" and a stroke of 66".

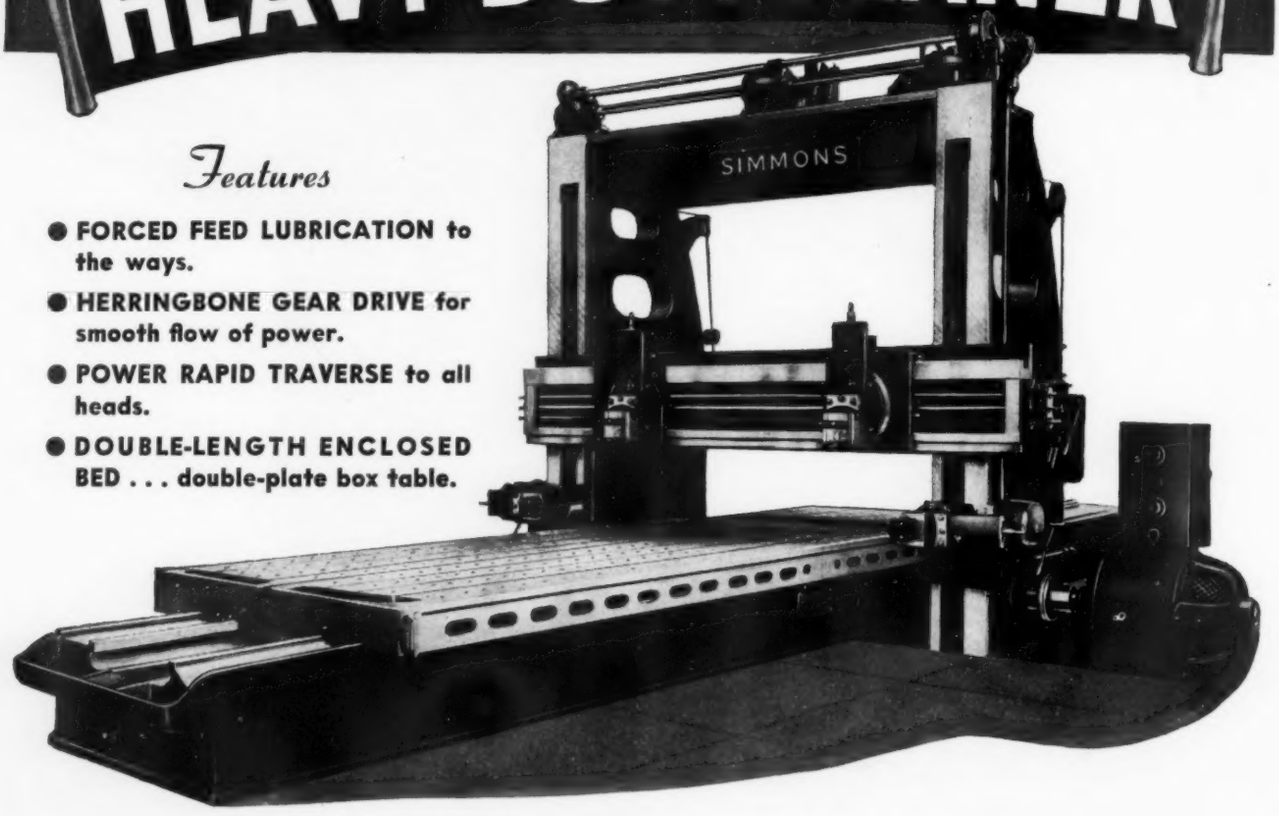
Press is installed and operating at the plant of a leading airplane manufacturer.

Clearing Machine Corporation
6499 West 65th Street • Chicago, Illinois

MECHANICAL AND HYDRAULIC PRESSES

CLEARING
MACHINE CORPORATION
CHICAGO

SIMMONS 120" x 96" HEAVY DUTY PLANER



Features

- **FORCED FEED LUBRICATION to the ways.**
- **HERRINGBONE GEAR DRIVE for smooth flow of power.**
- **POWER RAPID TRAVERSE to all heads.**
- **DOUBLE-LENGTH ENCLOSED BED . . . double-plate box table.**

POWER RAPID TRAVERSE TO ALL HEADS, operating through specially designed clutches. Traverse and Feed are interlocked, making it impossible to engage both at the same time.

DOUBLE-LENGTH ENCLOSED BED is provided with forced feed lubrication to the ways. At no time does the table extend beyond the end of the bed even at its maximum stroke.

INNER GUIDE BOX TABLE has one flat and one vee way, riding constantly on a film of oil delivered by pump into the bed channels for the entire length. Bottom side of the table is entirely closed and heavy ribs at short intervals tie top and bottom securely together. Stop holes are drilled from the solid to the center core, keeping them free from chips at all times.

SYKES HERRINGBONE GEARS, delivering a smooth, even flow of power, are used on all drive shafts up to the bull gear and pinion, which have spur teeth to mesh with the table rack. All drive gears and table rack are of high-strength steel. All shafts revolve with the gears and run in bronze bearings lubricated by forced feed, keeping the oil continually at the proper level.

ELECTRICAL EQUIPMENT includes constant potential reversing motor drive with 50 H.P. D.C. 230-v., 150-900 R.P.M. motor control, giving table speeds from 19 to 115 feet per minute.

OTHER IMPORTANT FEATURES: Box arch full depth of housing; ball thrust bearings on rail and sidehead feed screws; adjustable taper grips throughout; micrometer collars for horizontal and vertical feeds; power elevating device for rail; all gearing completely covered; rail clamp on inner and outer edge of housings. Write TODAY for descriptive bulletin.

SIMMONS MACHINE TOOL CORPORATION

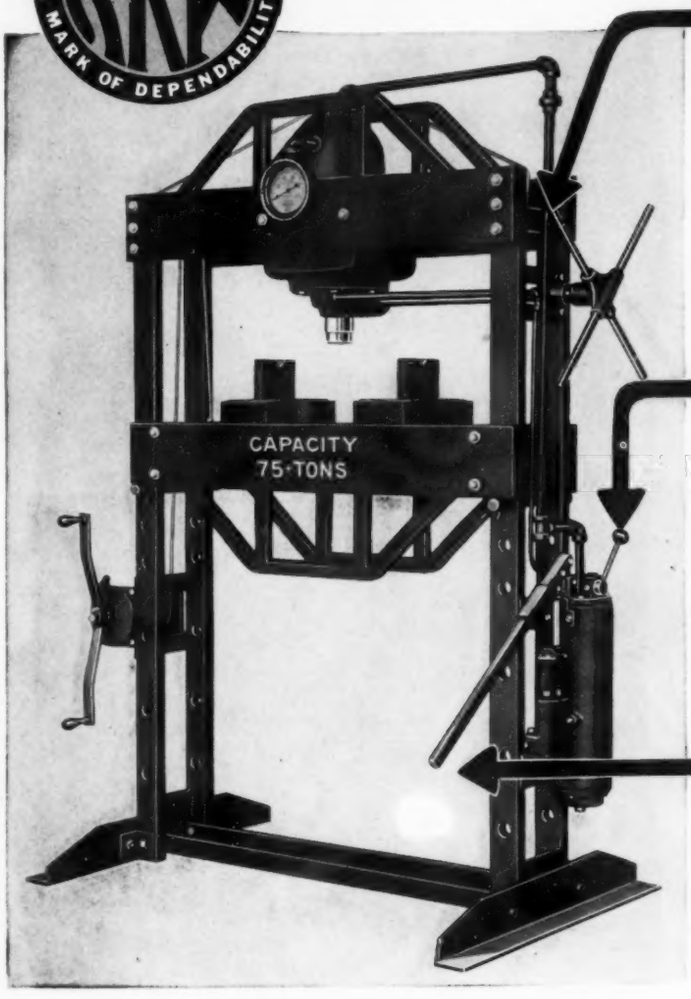
***Main Office:* 1759 NORTH BROADWAY, ALBANY, N. Y.** ***New York Office:* 149 BROADWAY**

SIMMONS

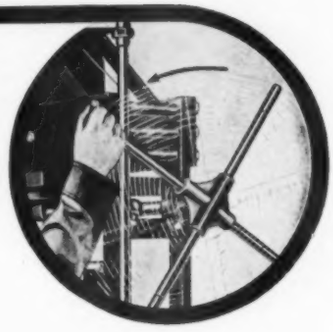
LATHES · TURRET LATHES · MILLERS · PLANERS · 6" BAR BORING MACHINES

Here's how SPEED is built into HYDRAULIC ARBOR PRESSES

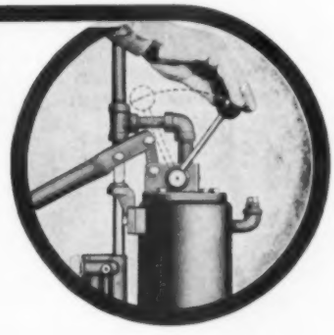
SINCE 1916 KRW A MARK OF DEPENDABILITY



1 **SPIN THE HAND-WHEEL** and the ram speeds to the work by fast mechanical action instead of slow, laborious hydraulic pumping.



2 **FLIP THE BALL ARM** to close the valve instead of slowly turning a handwheel type control.



3 **START PUMPING** and immediately get tons of pressure on the work because the hydraulic cylinder was automatically filled with oil during operation No. 1.

● The new KRW Presses are designed for SPEED... *speed* in bringing ram to the work ...*speed* in developing hydraulic pressure... *speed* in raising ram to remove the work. The "capstan" type handwheel raises the ram with the same mechanical speed employed in lowering it.

A *Two Speed Pump,* controlled by a quick, half turn of a finger lever, enables operator to select the speed best suited to the job—the double plunger action is 2½ times faster than the single action. Write for bulletin describing 25, 50 and 75 ton presses—priced from $198.00*.

*Prices F. O. B. Arcade, N. Y. Slightly higher west of Rockies

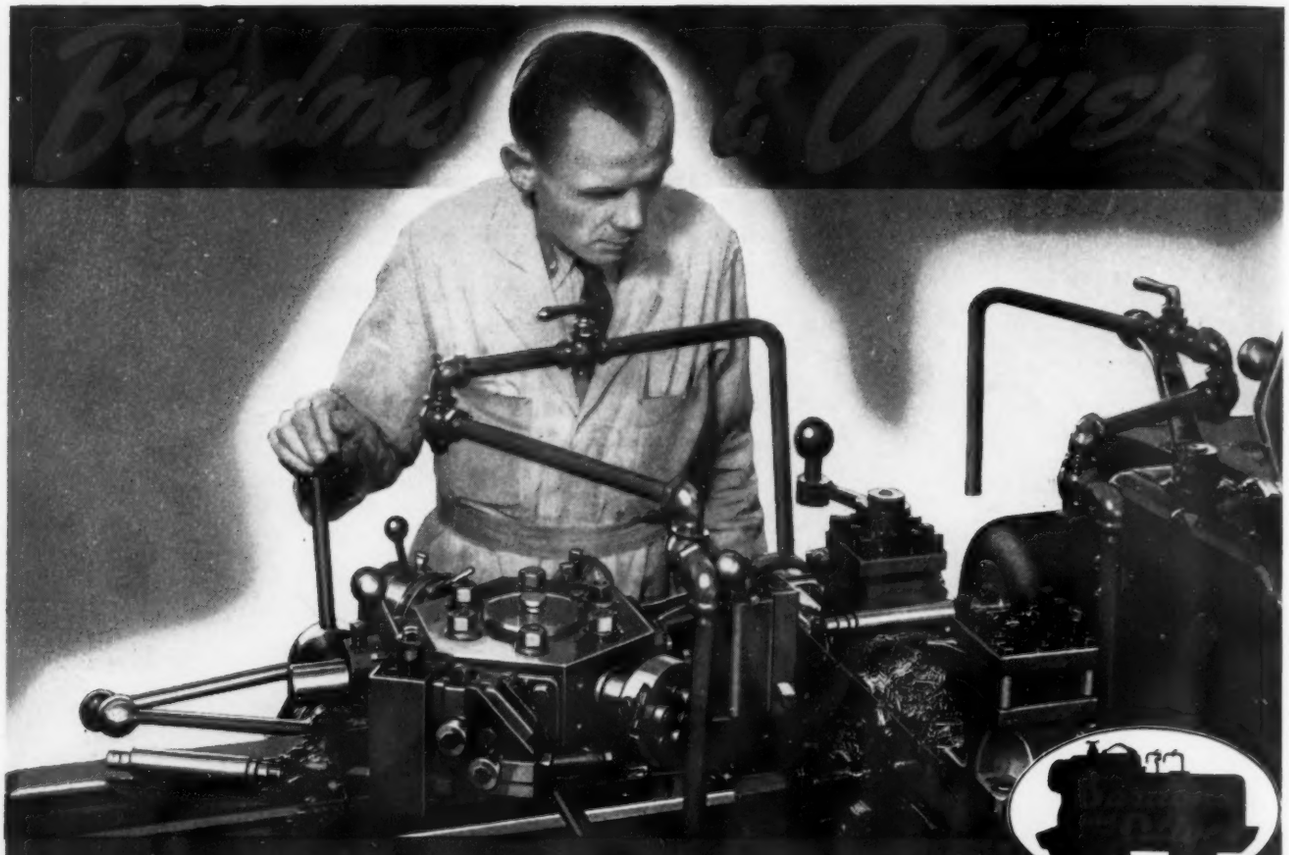
K. R. WILSON

MAIN OFFICE: LOCK ST., BUFFALO, N. Y., U. S. A.
EXPORT OFFICE: 90 WEST ST., NEW YORK, N.Y., U. S. A.
WEST COAST: Osborne Mach. Co., San Francisco, Calif., U. S. A.
Smith-Booth-Usher Co., Los Angeles, Calif., U. S. A.

MAIL THIS COUPON

K. R. WILSON, 38 Lock St., Buffalo, N. Y.
Please send Hydraulic Arbor Press Bulletin No. 38.

Name .....
Address .....
City ..... State .....



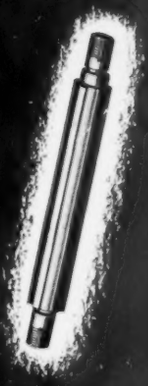
IF IT'S LOW COST OPERATION YOU WANT . . .

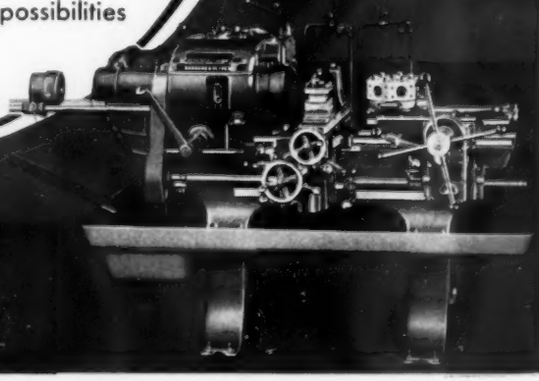
Put it on a Bardons & Oliver No. 3 UNIV[illegible] TURRET LATHE

The production of small parts in large or small quantities at low cost is the result of developing the Bardons & Oliver No. 3 Universal Turret Lathe to its present high degree of efficiency. By concentrating all control levers within convenient reach, and by light and easy manipulation of tool slides and speed and feed changes the operator' fatigue is reduced to a minimum. Yet the powerful drive, together with great rigidity permits multiple cuts, rapid removal of metal and step-up of production.

Due to great versatility this turret lathe is capable of handling an extremely wide range of bar, chucking, and second-operation work.

So, if you are interested in low cost operation write us for further information regarding the features and possibilities of this turret lathe.





BARDONS & OLIVER, INC.
1133 W. 9th STREET • CLEVELAND, OHIO

HOW TO GET THE MOST OUT OF YOUR LATHES

No. 2 in a series of suggestions made by the South Bend Lathe Works in the interest of more efficient war production.

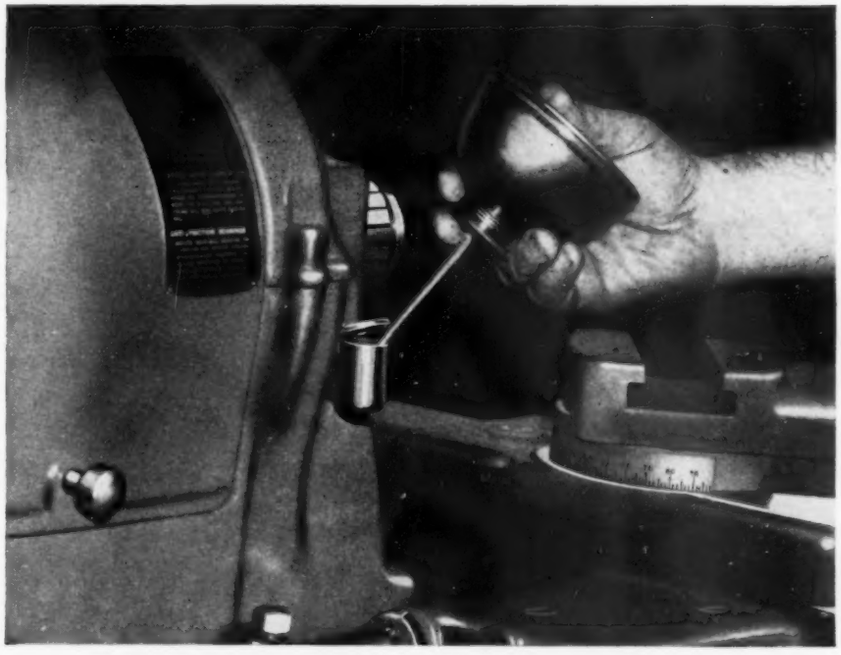
Keep Them Well Oiled

For lack of oil the bearing was lost;
For lack of a bearing the tank was lost;
For lack of a tank the battle was lost;
All for the lack of a film of oil.

Cleverly paraphrasing the ancient rhyme about the horseshoe nail, a young army officer is said to have used the above verse to emphasize the importance of lubrication in mechanized warfare. And this thought is just as applicable to the battle of production in American shops as it is to the tank battles in distant lands.

The proper lubrication of lathes and other machine tools will contribute much to our total war effort by preventing unnecessary interruption of production. It will also save scarce strategic materials and highly skilled technical labor by reducing to a minimum the demand for replacement bearings, parts, and machines.

South Bend Lathes, like other fine machine tools, have large oil reservoirs, felt wicks, and oil retainers to guard against lack of oil due to temporary neglect or oversight. But for best results the lathe should be oiled at regular intervals. Even a camel must have an occasional drink.



All bearings should be oiled at regular intervals

Make Oiling a Habit

All oil holes and oil cups on the lathe should be filled at least once a day — oftener when the lathe operates day and night — or when top speeds and feeds are employed. The best method is to fill each oil hole in a regular sequence so that oiling becomes a habit and no oil holes are overlooked. When the lathe is in service on two or more shifts, oiling the lathe should be the first daily task of each operator.

To help the inexperienced operator find the oil holes, a circle of brightly colored paint may be applied around each oil cup. Different colors of paint can be used to indicate different grades of oil.

Use Correct Grade of Oil

When the correct grade of oil is used in a well designed bearing there is little or no metal to metal contact and practically no wear. However, when the wrong grade of oil is used, or if the oiling is neglected, the oil film will break down and the fine finish of the bearing surface may be damaged in a short time.

The V-ways of the lathe bed, and the dovetails should be oiled as often as is necessary to maintain a good oil film. Touching the bed way with the tip of the finger will indicate whether or not it is coated with a film of oil.

Motors should be lubricated according to the motor manufacturer's instructions which are usually attached to the motor. Care should be taken to avoid getting oil on rubber V-belts or flat leather belts, as it is injurious to both.

Clean Lathe After Oiling

After the oiling has been completed, the excess of oil should be wiped off with a clean cloth. The lathe should be kept clean. Dirt, chips, or rust should not be allowed to collect.

Write for Bulletin No. H2

Bulletin No. H2 giving more complete information on oiling the lathe will be supplied on request. Oiling charts for South Bend Lathes, and reprints of this and other advertisements in this series can also be supplied. State quantity wanted, also serial numbers of lathes for which oiling charts are needed.

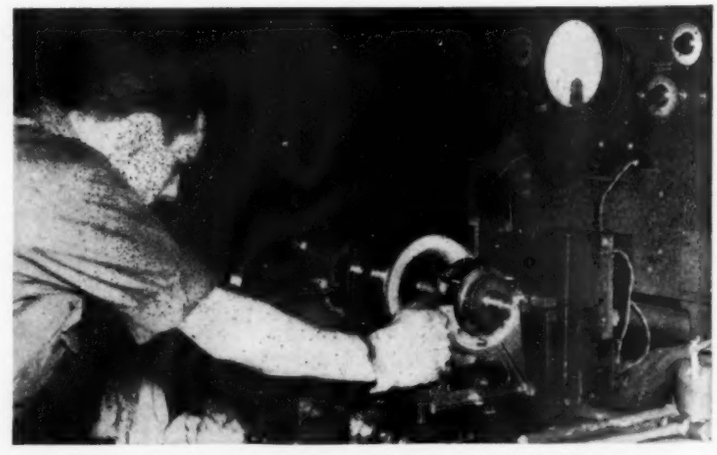
SOUTH BEND LATHE WORKS

Dept. 953 • South Bend, Ind., U. S. A. • Lathe Builders for 35 Years

WATCH IT, Professor! You're about to lose something—*your balance!* And that might cut short your whole career!

And to men in the field of mechanics, balance is no less important! In any assembly where parts rotate at high speeds, unbalanced static and dynamic forces mean vibration and noise. They mean excessive wear—a short life and a not-so-merry one!

Gisholt Balancing Machines enable you to measure unbalance vibrations as small as .000025″. Because you can now do it so accurately, so quickly, so economically —no vital rotating members in any good machine need pay the heavy penalty imposed for unbalance.



GISHOLT DYNETRIC MACHINES *indicate corrections required for all unbalanced forces—in a matter of seconds—and reduce costs accordingly. Literature on request.*

GISHOLT

GISHOLT MACHINE COMPANY, 1201 East Washington Avenue • Madison, Wisconsin

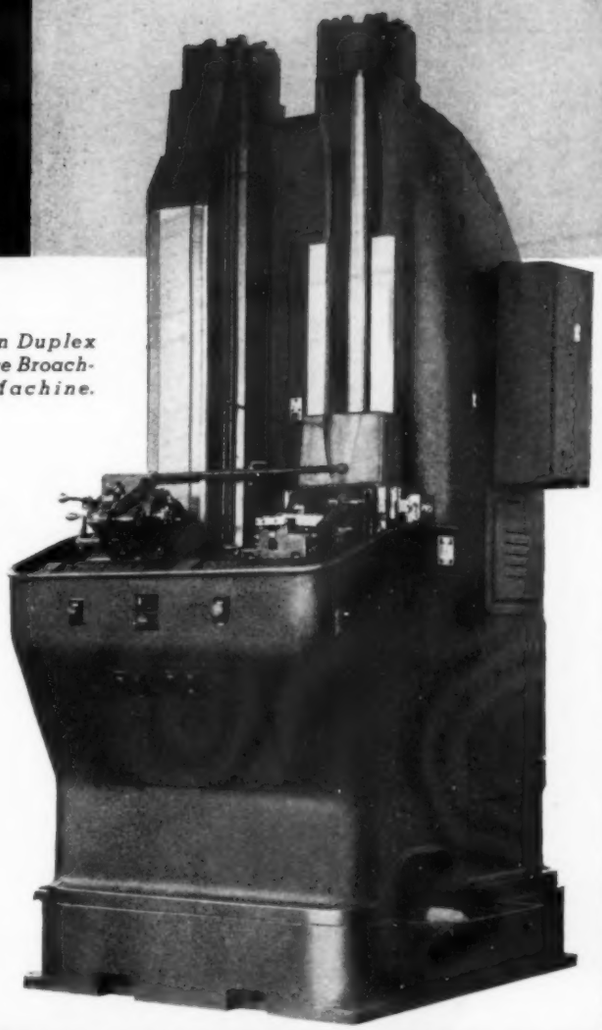
LOOK AHEAD . . . KEEP AHEAD . . . WITH GISHOLT IMPROVEMENTS

TURRET LATHES • AUTOMATIC LATHES • BALANCING MACHINES

A second duplex machine surface broaches sides and radii at each end. One slide is used for each side of the piece.

Two broaching operations on one duplex machine, close tolerance being obtained by using first cut on one side for location in machining other side.

Surface Broaching FOR FASTER PRODUCTION



25 Ton Duplex Surface Broaching Machine.

• The problem of faster production on many vital war items has been solved by Footburt surface broaching. This modern machining method may be used for roughing and finishing one or more flat or irregular surfaces in one operation. With surface broaching the cut is evenly distributed over the entire length of the broach and each tooth has a predetermined amount of metal to remove. Roughing teeth are never used for finishing and finishing teeth are never used for roughing. This makes broaches last longer and makes tool maintenance costs lower than with any other machining method.

Your blueprint with production requirements will enable us to analyze the possibilities of speeding your war work with surface broaching.

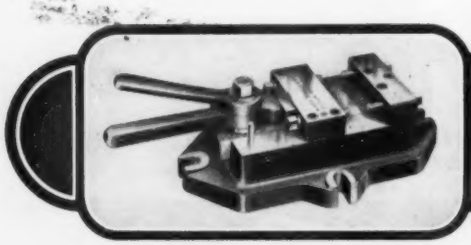
THE FOOTE-BURT COMPANY
CLEVELAND, OHIO
Detroit Office: 4-253 General Motors Building

FOOTBURT *Surface* **BROACHING**

PHOTO BY U. S. ARMY SIGNAL CORPS

They just keep rolling along!

In Lybia, Australia, Russia and other battle fields of the world, American built tanks are demonstrating their speed, maneuverability and firepower. Whether ten ton or sixty ton — these war monsters require accurate machine work, with parts built to close tolerances, in order to perform their tasks dependably. The facilities of this modern plant are enlisted in the service of victory, producing vital parts which find their way to the production lines of builders of tanks, planes and ships. Keep the name FENN in mind as a dependable source of machine parts production — in the future.



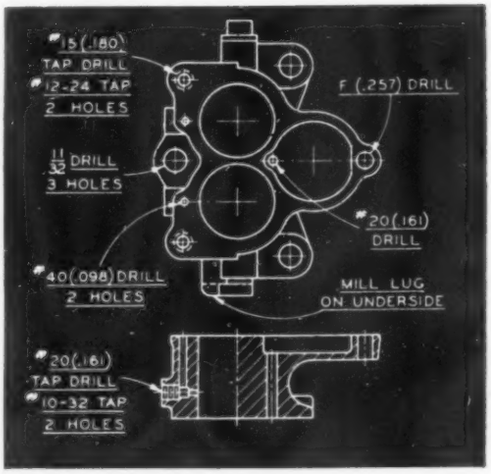
The Fenn Manufacturing Co.

HARTFORD, CONNECTICUT - - ESTABLISHED 1900

FLEXIMATIC

The THRIFTY Way

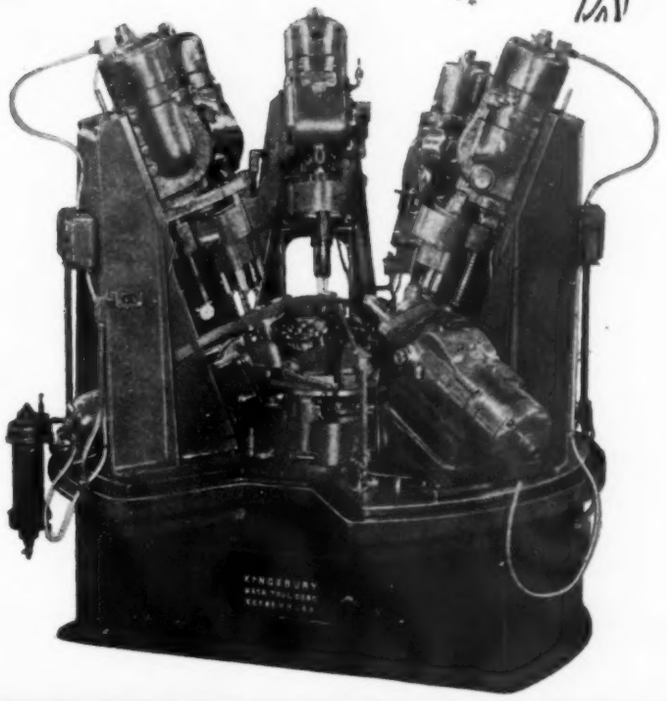
To Solve Production Problems



THIS IS A FLEXIMATIC JOB!

Over a dozen operations on the carburetor throttle valve bodies shown — and Kingsbury FLEXIMATICS perform the entire job in a single chucking of the work! An example of the thrifty way to solve multiple-operation production problems.

FLEXIMATICS are built up of standard Units, set up on a standard base around an automatically indexing work-holding turret. This unit system of construction keeps first costs low—out of the "special machine" class. And in addition, FLEXIMATIC Units can be changed, moved around and mounted in any combination on the base to meet the machining requirements of many different parts. That is why we say that **flexible automatic** FLEXIMATICS are the THRIFTY way to solve production problems.



KINGSBURY MACHINE TOOL CORPORATION

KEENE NEW HAMPSHIRE U.S.A.

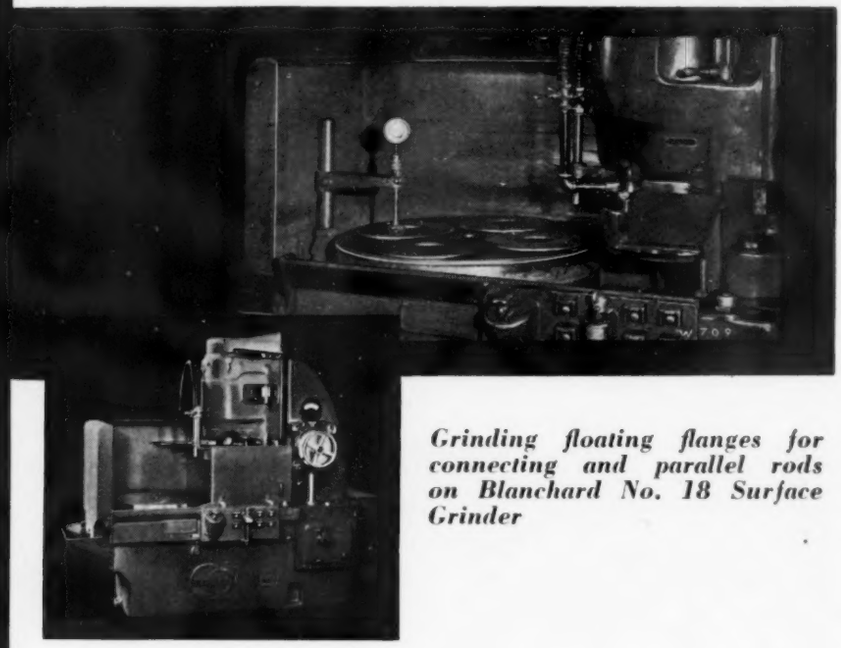
"PUT IT ON THE BLANCHARD"

BLANCHARD

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- ★ **Production**
- **Adaptability**
- **Fixture Saving**
- **Operation Saving**
- ★ **Material Saving**
- **Fine Finish**
- **Flatness**
- **Close Limits**

★ . . . . . *Especially valuable on jobs like the one illustrated.*



Grinding floating flanges for connecting and parallel rods on Blanchard No. 18 Surface Grinder

THE Blanchard No. 18 Surface Grinder, shown above, is used for odd lot jobs in one of this country's leading railway shops. Other jobs up to 36″ in diameter are also ground on this machine.

The job shown is boiler steel floating flanges for connecting and parallel rods. 1/32″ of stock is removed from both sides to limits of .002″ for flatness. 37 pieces (72 surfaces) are produced per hour.

These odd lots are ground at a profit on the Blanchard No. 18 because the set-ups may be changed quickly—the required limits and finish are easily maintained and held—and maximum production is obtained.

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE, MASS.

"Performance has established leadership for HARDINGE High Speed Precision Machines"

HARDINGE High Speed Precision Machines with preloaded ball bearing spindle construction are *fast, accurate* and *dependable*. This combination, together with the ease and simplicity of operation, enables relatively unskilled operators to rapidly produce parts to the necessary close limits without expensive tooling.

HARDINGE
HIGH SPEED
PRECISION LATHE

HARDINGE
HIGH SPEED PRECISION
SECOND OPERATION MACHINE

HARDINGE
HIGH SPEED PRECISION
TOOL-ROOM LATHE

ARDINGE
IGH SPEED PRECISION
ILLING MACHINE

IT PAYS 5 WAYS

TO *Standardize* ON EX-CELL-O THREAD GRINDERS

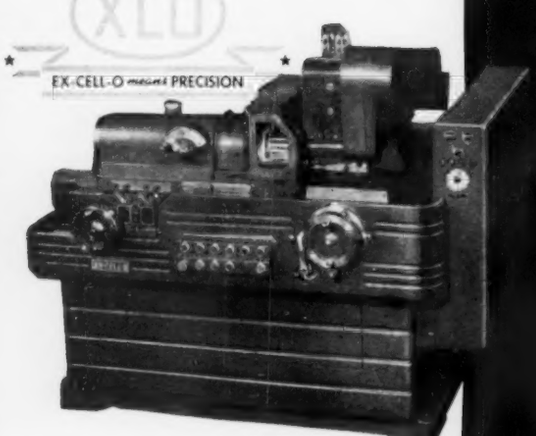
1 DESIGN . . . Ex-Cell-O engineers, who introduced precision thread grinding to U.S. industry, are familiar with today's threaded work needs. Ex-Cell-O thread grinders are designed to meet these needs specifically.

2 CONSTRUCTION . . . Ex-Cell-O thread grinders are substantially, compactly built—to give years of service—with base, work table, controls, compartments, etc., all integral parts of a uniform exterior design. Moving parts are made for *precision* operation. Work table slides, for instance, are heavily ribbed and normalized to eliminate warpage. Hardened, ground and lapped steel rollers support work table on scraped ways. Anti-friction rollers are retained in steel carriers so that table moves with uniform freedom, preventing variation of table drag that would affect accuracy of work.

3 ADAPTABILITY . . . Within the designed capacity of each of nine Ex-Cell-O standard thread grinding machines—automatics, universals, and plain production—a wide range of work is possible. Users of Ex-Cell-O precision thread grinders are finding that on many work pieces more overall speed and economy are attained by precision grinding *all* threads called for, including even those not requiring the extreme accuracy of grinding.

4 WIDE VARIETY OF STYLES . . . Ex-Cell-O has developed precision thread grinding to cover the many requirements of American industry for precision threaded work. There are available nine different styles of Ex-Cell-O thread grinders—*all standard machines*—with greatest practical interchangeability in use of dressers and lead screw and nut assemblies.

5 MADE BY DEPENDABLE FIRM . . . Only one standard is acceptable at Ex-Cell-O—the greatest commercial accuracy it is possible to attain, whether it be in the designing of precision thread grinders or any of the various other precision machines and tools bearing the Ex-Cell-O name.

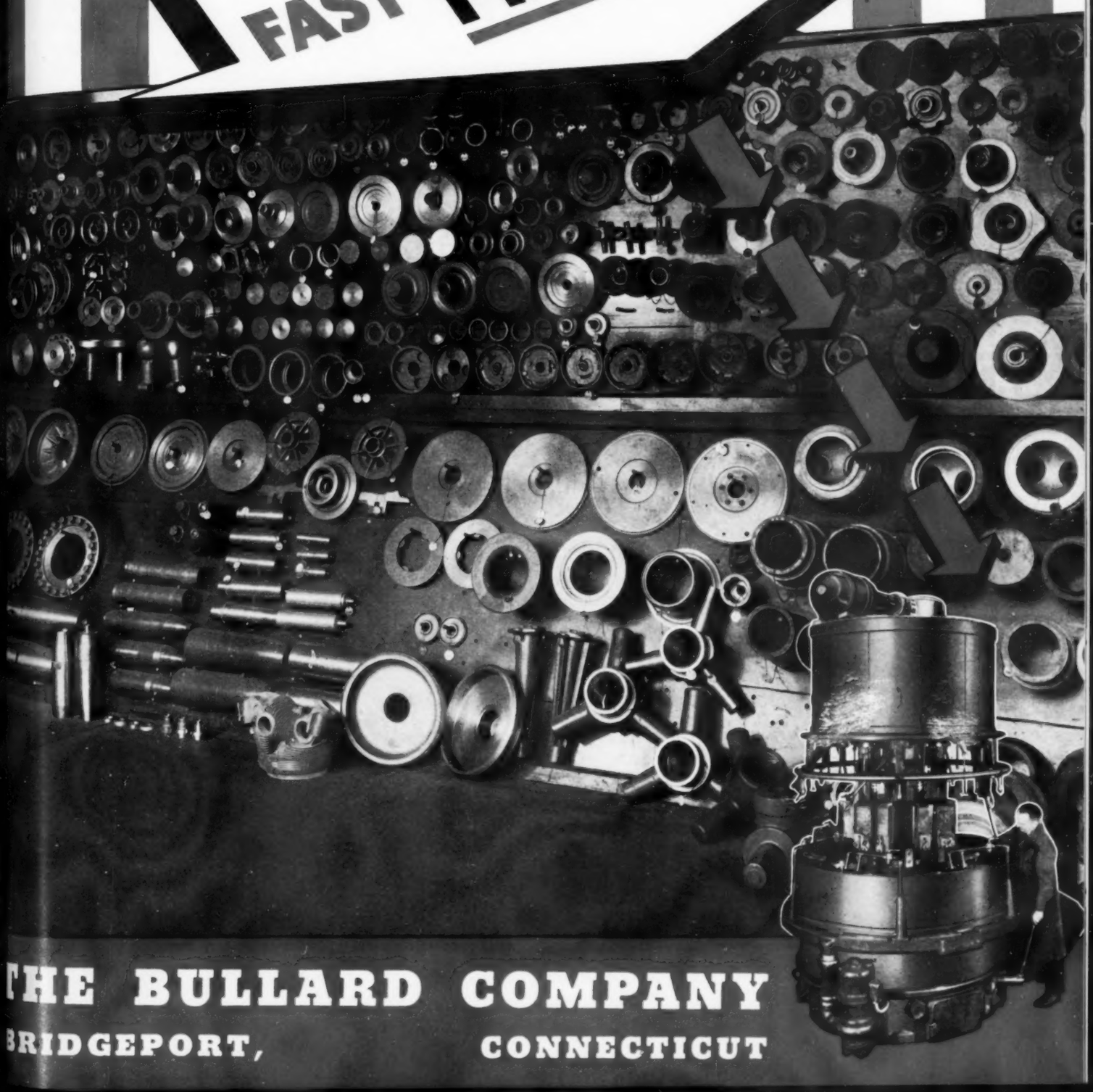


Above: *Ex-Cell-O Style 39-A . . . for precision grinding internally threaded work. One of nine styles of Ex-Cell-O standard thread grinders.*

Precision THREAD GRINDING, BORING AND LAPPING MACHINES, TOOL GRINDERS, HYDRAULIC POWER UNITS, GRINDING SPINDLES, BROACHES, CUTTING TOOLS, DRILL JIG BUSHINGS, PARTS

EX-CELL-O CORPORATION • DETROIT

PUT JOBS LIKE THESE ON A MULT-AU-MATIC IF YOU REALLY NEED FAST PRODUCTION



THE BULLARD COMPANY

BRIDGEPORT, CONNECTICUT

To Finish The Job Quicker:

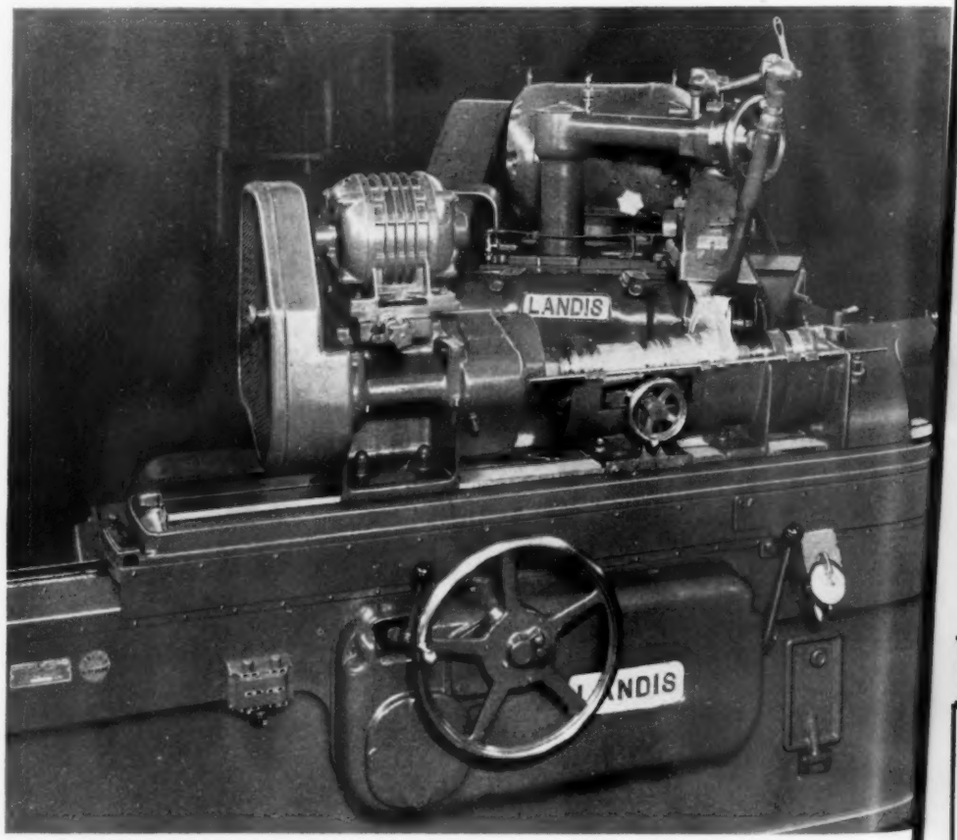
"LANDIS" AIRPLANE PRO

With a roar, the plane lifts into the air and is off. Again we are reminded of the importance of things unseen.

Take, for example, the propeller shaft of that plane which has just soared away so gracefully. Its manufacture was a long careful process, with many grinding operations required. Because of the nature of the part, some of the operations were conventional, while others were unconventional, necessitating the use of numerous elements of special tooling.

Leading propeller manufacturers are aware of all this and they are using Landis Grinders extensively to help solve their many grinding problems. Three of the more unusual operations are pictured and described here. The conventional ones, that is grinding the front and rear plain diameters, are performed on standard Landis 14"x36" Type C Plain Hydraulics.

As new needs arise or production requirements are stepped up, the long experience of Landis in supplying equipment of this kind is available to those who may have need of it.



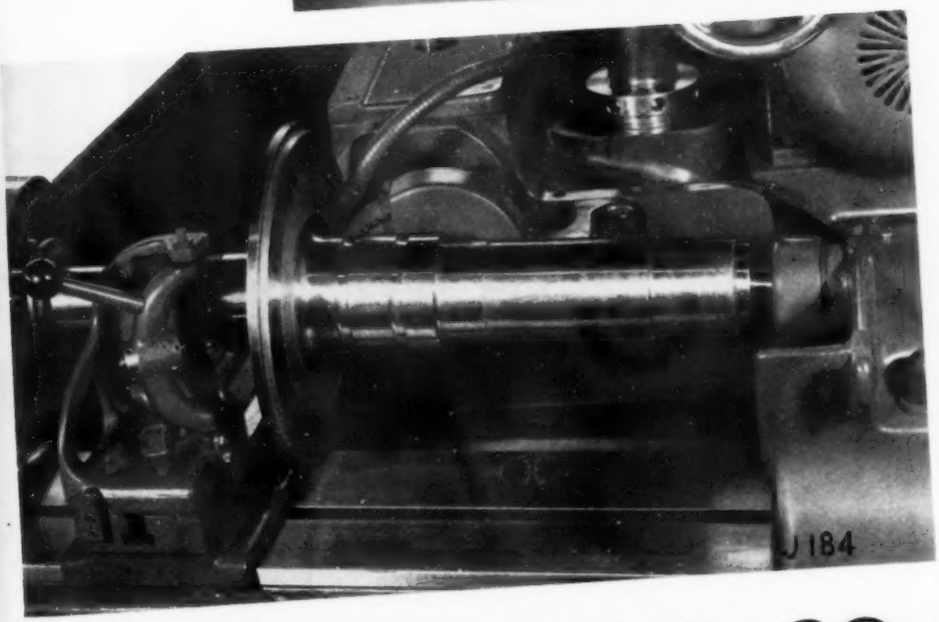
Grinding the front face of the flange on a Landis 14" x 36" Type C Plain with right-hand wheel mounting and wheel base set at an angle. Shaft is turned end for end to grind rear face of flange on same machine.

PRECISION LANDIS GRINDERS

Unusual Performance as Usual

GRIND YOUR PELLER SHAFTS

Grinding 1" radius and bearing diameter adjoining radius to blend into relieved face. **Again, wheel base is set at an angle and right-hand wheel mounting is employed.**



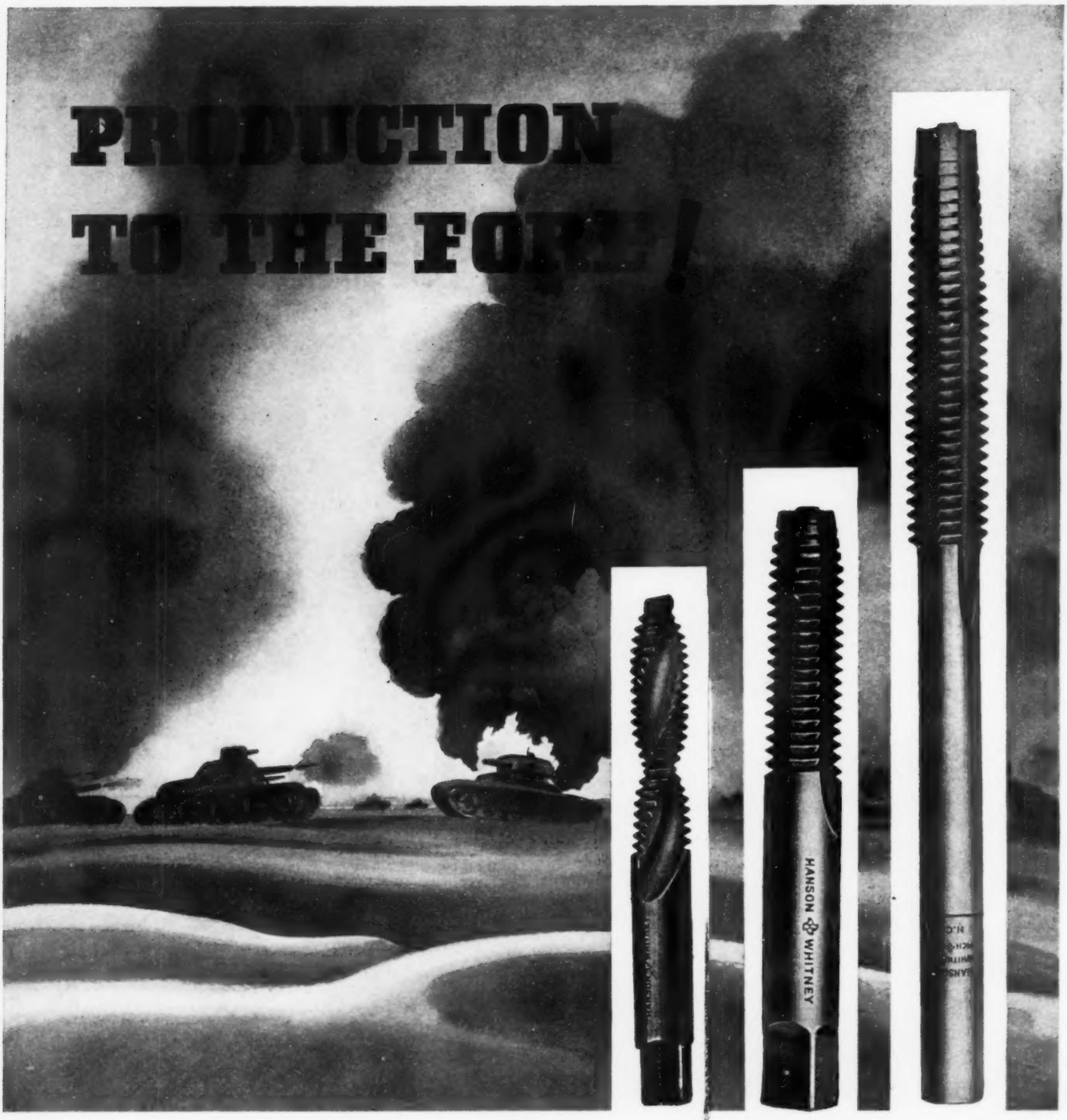
Form grinding fillet extending under rear face of flange **on a Landis 14" x 36" Type C Hydraulic Universal. A right-hand wheel mounting and small diameter wheel are used.**

LANDIS TOOL CO. WAYNESBORO, PENNSYLVANIA

LANDIS EXCELLENCE

CONTRIBUTES TO VICTORY

403



This war will be won on the production lines of America. Down time and rejects are casualties on the road to Victory. DON'T TAKE A CHANCE! Speed up production by looking for the "Hanson Process" Emblem on the taps you buy. H-W Taps deliver long, accurate runs between grinds . . . retain precision longer . . . because our exclusive method of finishing after hardening insures uniform grain structure from tip to shank. For detailed information write

"HANSON" PROCESS

LOOK FOR THIS EMBLEM

The HANSON WHITNEY MACHINE CO

HARTFORD CONN., U.S.A.

Are You Heat-treating Parts That Require INDIVIDUAL HANDLING?

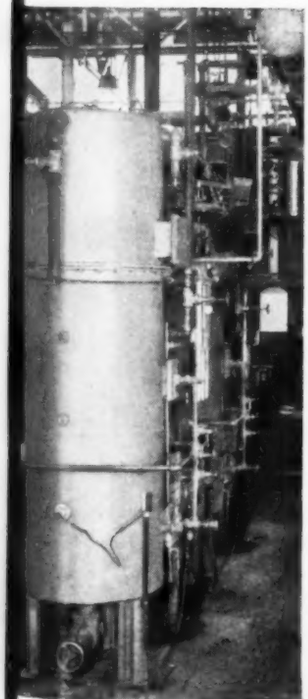
That's the Job for a ROTARY Hearth if you want

1. Accurate Hardening

2. Continuous Operation

Very little labor is required for operation. Charge and discharge doors are together so one workman can tend both

—and for NO DECARB Use a G-E Furnace with Drycolene



Battery of drycolene producers connected to common header for supplying atmosphere to a group of furnaces

FOR heat treating high-carbon, alloy-steel parts decarb free, General Electric now offers a rotary-hearth furnace that can be used with drycolene.

This furnace affords an easy and simple method of hardening parts that must be fixture quenched. Parts that require careful individual handling, such as gears and shafts.

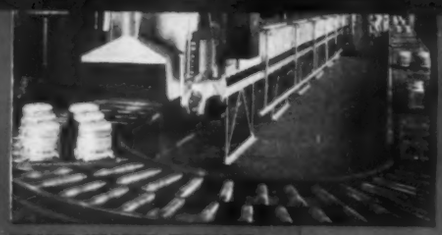
With this furnace and drycolene producer you can be sure of getting uniformly hard work without decarburization, and in one continuous operation.

If you have a heat-treating problem, get in touch with the nearest G-E office. Our engineers will make a study of it, and recommend the right furnace for the job, selected from dozens of tested and proved G-E heat-treating equipments that are available. *General Electric, Schenectady, N. Y.*

BUILDER OF FURNACES FOR PRACTICALLY EVERY INDUSTRIAL NEED

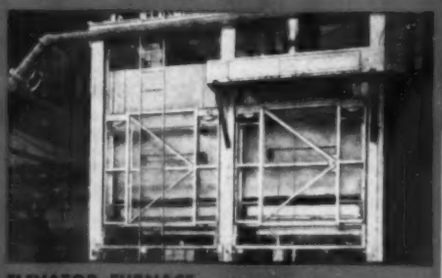
The Navy "E", for Excellence, has been awarded to 92,780 General Electric employees in six plants manufacturing naval equipment

GENERAL ELECTRIC

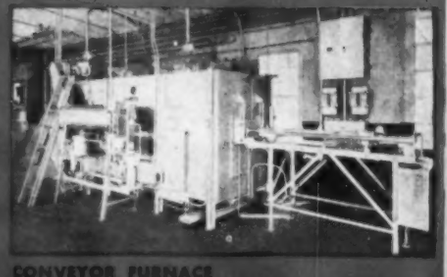


ROLLER-HEARTH FURNACE

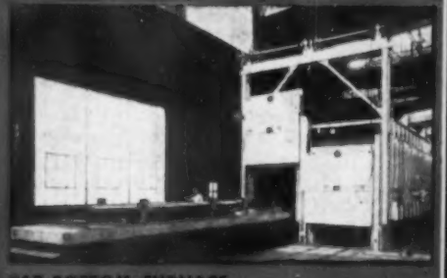
PIT FURNACE



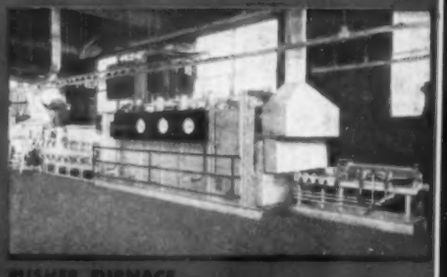
ELEVATOR FURNACE



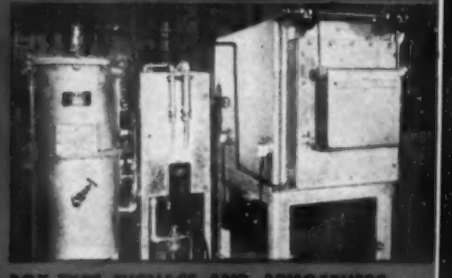
CONVEYOR FURNACE



CAR-BOTTOM FURNACE

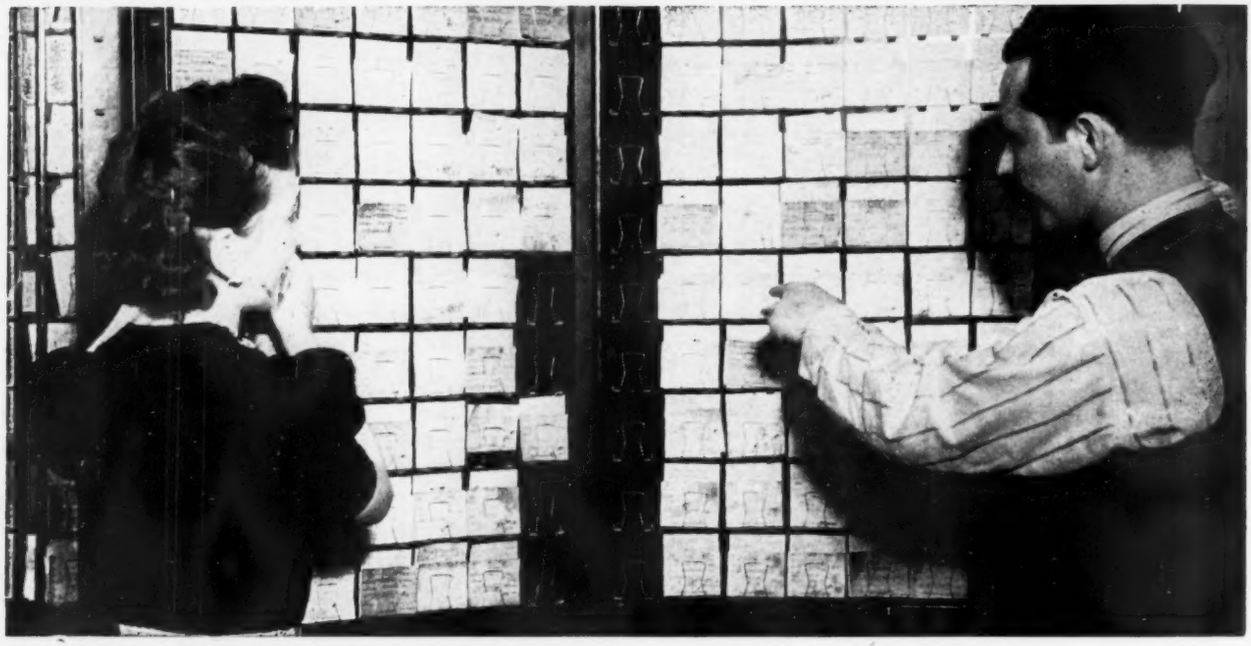


PUSHER FURNACE



BOX-TYPE FURNACE AND ATMOSPHERE-CONTROL EQUIPMENT

FIGHTING *one production emergency after another?*



Investigate McCASKEY PRODUCTION CONTROL

McCaskey Controls have been developed the practical way, working with thousands of production men in their plants to visualize the data that prevent production emergencies. Needs experienced through more than a score of years have provided the basis of McCaskey systems that are short-cutting red tape and clerical work in numerous war plants. They are providing, for example:

A simple method of coordinating the flow of finished parts required for assembly to avoid delays resulting from missing parts . . .

Forecasting production delivery . . .

Meeting delivery dates promised . . .

Scheduling machines, determining machine loads and making job assignments so that all machines may be put to work and worked all the time . . .

Checking machine production to make sure that standards set are realized . . .

Following-up production without dependence on stock chasers . . .

Providing day-to-day cost and payroll data for immediate control of unexpected increases . . .

The simplest possible control of production is most essential today. Systems that require numerous stock chasers and production clerks to compile data will lead to difficulty sooner or later. Clerical turnover, already serious, is increasing rapidly.

Let us give you specific information about the application of McCaskey Controls to your requirements and explain how they are provided with a minimum of clerical effort. Experienced representatives are available to analyze your requirements and offer practical recommendations. No obligation. Write today.

Report from well known plant
Using McCaskey production control system

McCaskey Controls enable us to intelligently schedule machine operations and delivery of raw materials and to follow up each operation on hundreds of production orders from a centralized control point. The exact status of any order of the hundreds in process may be determined at a glance without the necessity of employing production chasers.

Accurate costs are obtained with very little clerical work. Cost data are almost immediately available, not only when the job is completed but at any time during operation. The system gives us a much closer control of shop orders and enables us to make reliable promises to customers and keep them.

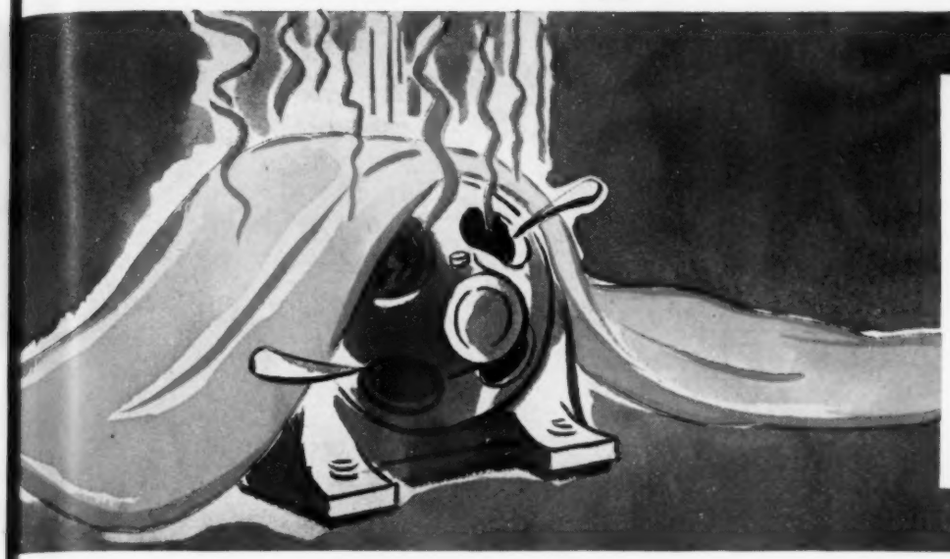
THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems Ltd., Galt, Ontario, Canada — *The McCaskey Register Co., Watford, England*

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

War Against Wear

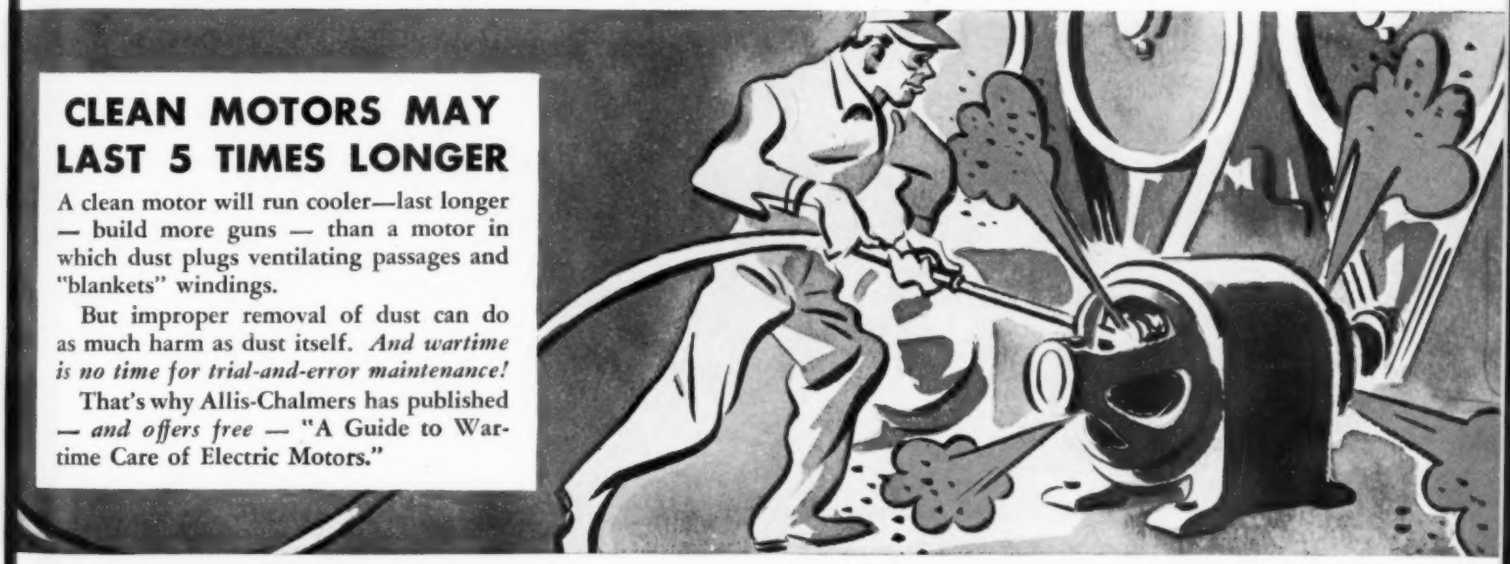


DUST "BLANKET" NOW MORE DANGEROUS

The more dust that accumulates in the wound section to "blanket" a motor, the more danger of destructive temperatures. *And today's round-the-clock operation gives a motor little chance to cool off!*

In a production war like this one, everything that harms our motors helps the Axis. Dust, moisture, stray oil, friction — *every* motor enemy must be fought with skill and energy!

IS PART OF THE WAR
Against the Axis

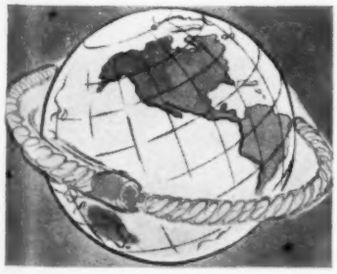


CLEAN MOTORS MAY LAST 5 TIMES LONGER

A clean motor will run cooler—last longer — build more guns — than a motor in which dust plugs ventilating passages and "blankets" windings.

But improper removal of dust can do as much harm as dust itself. *And wartime is no time for trial-and-error maintenance!*

That's why Allis-Chalmers has published — *and offers free* — "A Guide to Wartime Care of Electric Motors."

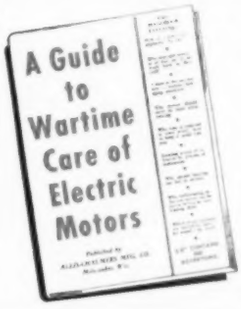


AROUND WORLD IN 8 DAYS — rotor travel in many motors working 24 hours a day for Victory!

Send for this Valuable new Book. It's Free! →

Everyone taking a fresh, new look at his maintenance operation will find "A Guide to Wartime Care of Electric Motors" immensely helpful.

It's completely illustrated, clear, highly interesting—applies to *all* makes of standard, general-purpose motors. Contains no advertising. Belongs in every engineer's and executive's technical library.



ALLIS-CHALMERS MFG. CO.
Advertising Dept.
Milwaukee, Wisconsin

Yes, I would like to receive *free of charge* your new motor care book.

(Name)

(Title)

(Company)

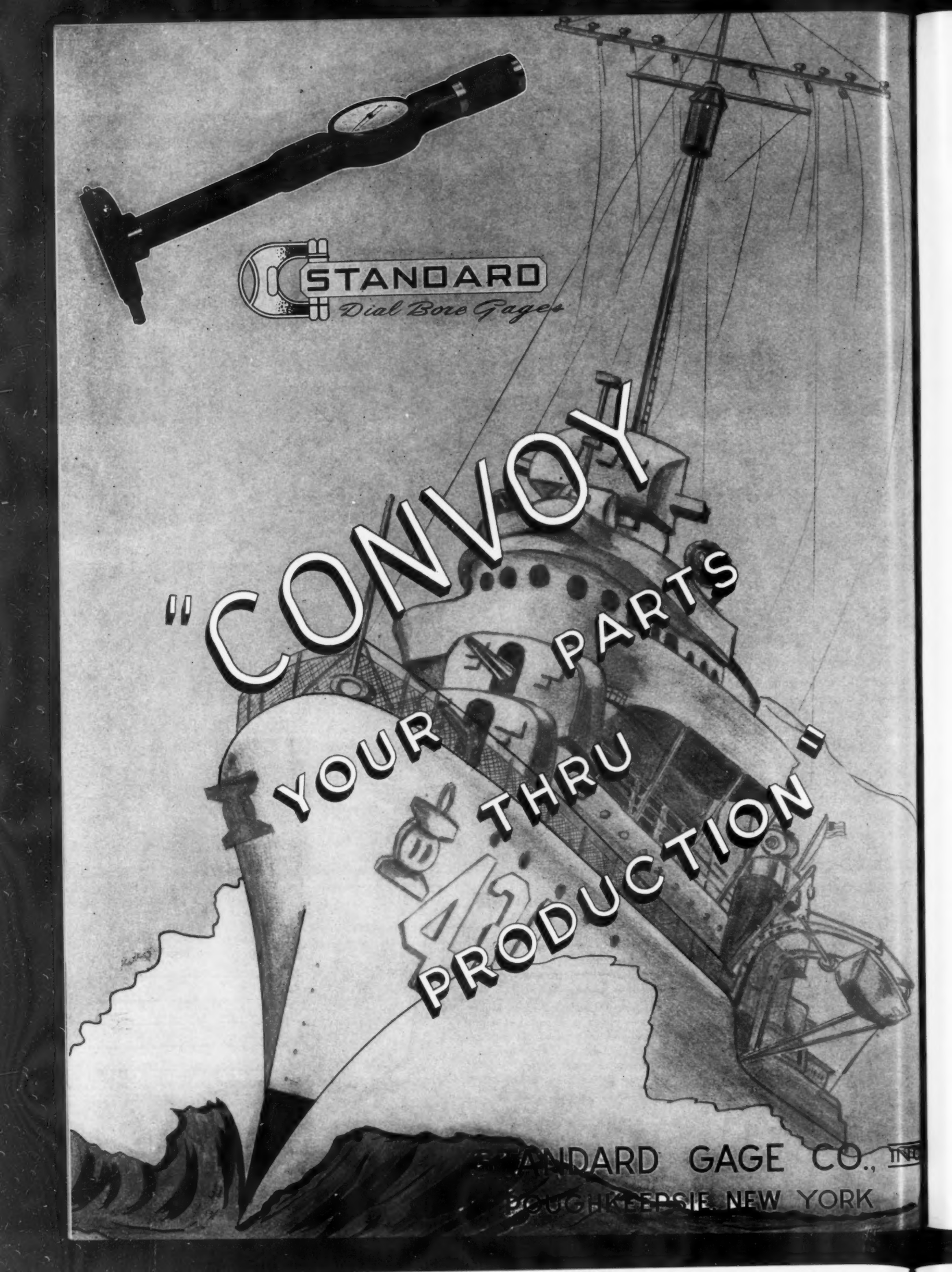
(Street Address)

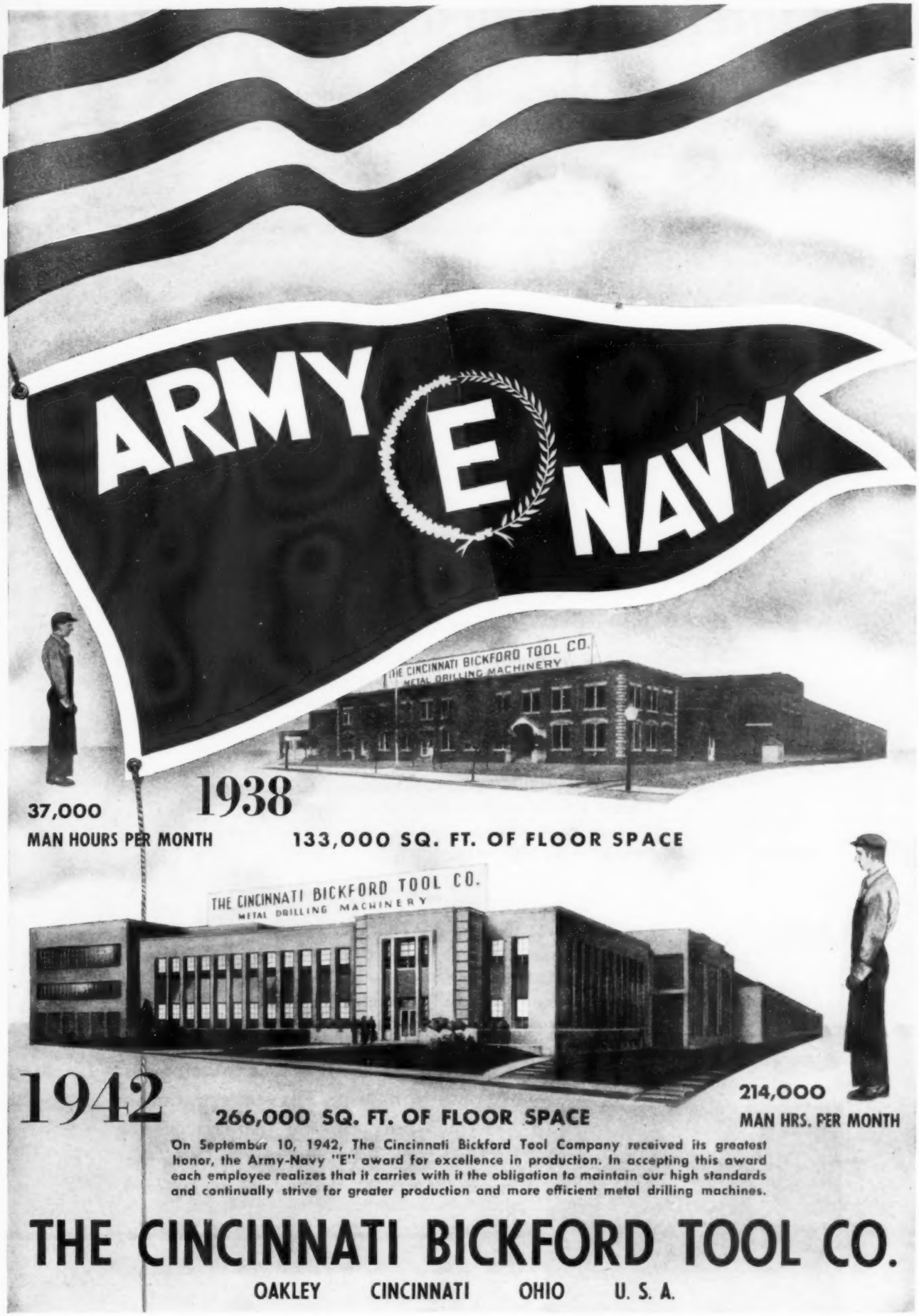
(City and State)

A 1536-5

ALLIS-CHALMERS
MILWAUKEE · WISCONSIN

WE WORK FOR VICTORY — WE PLAN FOR PEACE


STANDARD
Dial Bore Gages
"CONVOY
YOUR PARTS
THRU
PRODUCTION"
STANDARD GAGE CO., INC.
POUGHKEEPSIE, NEW YORK


ARMY
E
NAVY
THE CINCINNATI BICKFORD TOOL CO.
METAL DRILLING MACHINERY
1938
37,000
MAN HOURS PER MONTH
133,000 SQ. FT. OF FLOOR SPACE
THE CINCINNATI BICKFORD TOOL CO.
METAL DRILLING MACHINERY
1942
266,000 SQ. FT. OF FLOOR SPACE
214,000
MAN HRS. PER MONTH
On September 10, 1942, The Cincinnati Bickford Tool Company received its greatest honor, the Army-Navy "E" award for excellence in production. In accepting this award each employee realizes that it carries with it the obligation to maintain our high standards and continually strive for greater production and more efficient metal drilling machines.
THE CINCINNATI BICKFORD TOOL CO.
OAKLEY CINCINNATI OHIO U. S. A.

It is later (and worse) than you think!

Wishful thinking is an American habit. Another name for it is "kidding ourselves." Ordinarily it isn't serious. But this time it can cost us our lives.

"This country has never been beaten in all its 166 years."

Japan has never been beaten in its 2000 years.

"They can't get at us, 3000 miles away."

Japan got to Burma 3600 miles away—and conquered it.

"Anyway, we're pouring it out of our factories."

But Germany has been doing just that for 10 years—and at a faster rate per man than we have yet reached.

"Our boys are brave."

You bet they are. But they're up against fanatics, who are experienced campaigners.

"Our Allies will hold until we get there."

Singapore, Philippines, Pearl Harbor, Burma—and now Libya.

"The Government is handling the war."

Who IS the Government except YOU? And if YOU don't do YOUR part, don't blame "the Government" when you slave for Jap and German masters at starvation wages with NO rights and NO liberties.

"But I can't give up my rights."

NO? Our soldiers have. Most managers have. Almost all owners have. And unless EVERYONE gives up EVERY "right" that slows war production, the Jap and German will TAKE your rights—every one of them—FOREVER.

"Anyway, what can one man do?"

What if all the other 130,000,000 Americans felt the same? If you do, they have a right to. And too many do. Nobody else is going to win this war for you. YOU win it—or YOU lose it. And if you lose it, you and your family will pay for it in agony and starvation the rest of your lives. Ask the Poles, the Czechs, the French.

WARNER & SWASEY
Turret Lathes
Cleveland

And this war is nearer to being lost than you think. That isn't pessimism—it's only looking the facts in the face. *Work* by *you* can save it. But *—there isn't much time to get busy.*

WHAT'S IN THIS ISSUE

METAL SHOW

Today, more than ever, production men are keeping their eyes open for new methods and new equipment that will aid them in stepping up production. An opportunity is offered by the National Metal Congress and Exposition to be held October 12–16. The Show-in-Print Section in this number gives a preview of some of the new equipment to be displayed at that time. See the show if you can; but at any rate, study the new facilities for metal-working which are shown here. Page 1063.

SPRAYED METAL

A lot has been written on sprayed metal, but until now practically nothing has appeared on how to finish the surfaces after spraying. Since their composition differs from that of the parent metal, certain rules must be followed in the selection of tools and grinding wheels. W. C. Reid, vice-president, Metallizing Engineering Company, gives specific data on the subject. Page 1084.

PAUL MITCHELL

JIGS FOR NACELLES

Vultee Aircraft has abandoned older methods of fabricating nacelle subassemblies in favor of well designed jigs for the purpose. These jigs hold the stainless steel parts accurately, and locate the spot welds which join them together. The better and faster job that results is described by Paul Mitchell, Vultee project tool engineer. Page 1114.

T. H. GRAY

HARDNESS TESTS

What properties do hardness tests measure? What do they prove? How do they compare? These are some of the questions that have plagued metallurgists and inspectors for years. T. H. Gray, Westinghouse Research Laboratories, throws a lot of light on the subject in his article, "How to Use Hardness Tests". Page 1075.

INDUCED HEAT

Heating by electrical induction has long been used for melting; today it is used for hardening, annealing, brazing and forging. A timely summary of induction heating, by Rupert LeGrand, begins in this issue. Page 1079.

WELDING MOVIES

Recently the General Electric Company brought out a film, "The Inside of Arc Welding," which shows many things that go on when an arc is used that cannot be seen with the eye. Some of the points emphasized in the film for the production of better welds are shown in a picture spread. Page 1082.

HEAT-TREATING ALUMINUM

Two articles in the Armament Section tell of new methods for heat-treating aluminum aircraft parts. One of these, by T. E. Piper, describes the furnaces used by Northrop Aircraft, Inc. which have the heating chambers directly over the quenching tanks. The second method, used by North American Aviation, is described by Royal B. Jackman. A spray booth reduces the time between heating and quenching. Pages 1107 and 1111.

SEAMLESS BOMBS

J. B. Nealey, Ordnance Department, U. S. Army, tells how seamless bomb bodies are fabricated from flat steel sheets. The method is somewhat like that used on cylinders for compressed gases. Page 1117.

J. B. NEALEY

N. E. STEELS

Steels are not what they used to be. Because of the vital necessity of stretching out alloying elements, an entirely new family of steels has been devised for industry. Our "blue" section on the "Working of National Emergency Steels" fits right into this development. Page 1093.

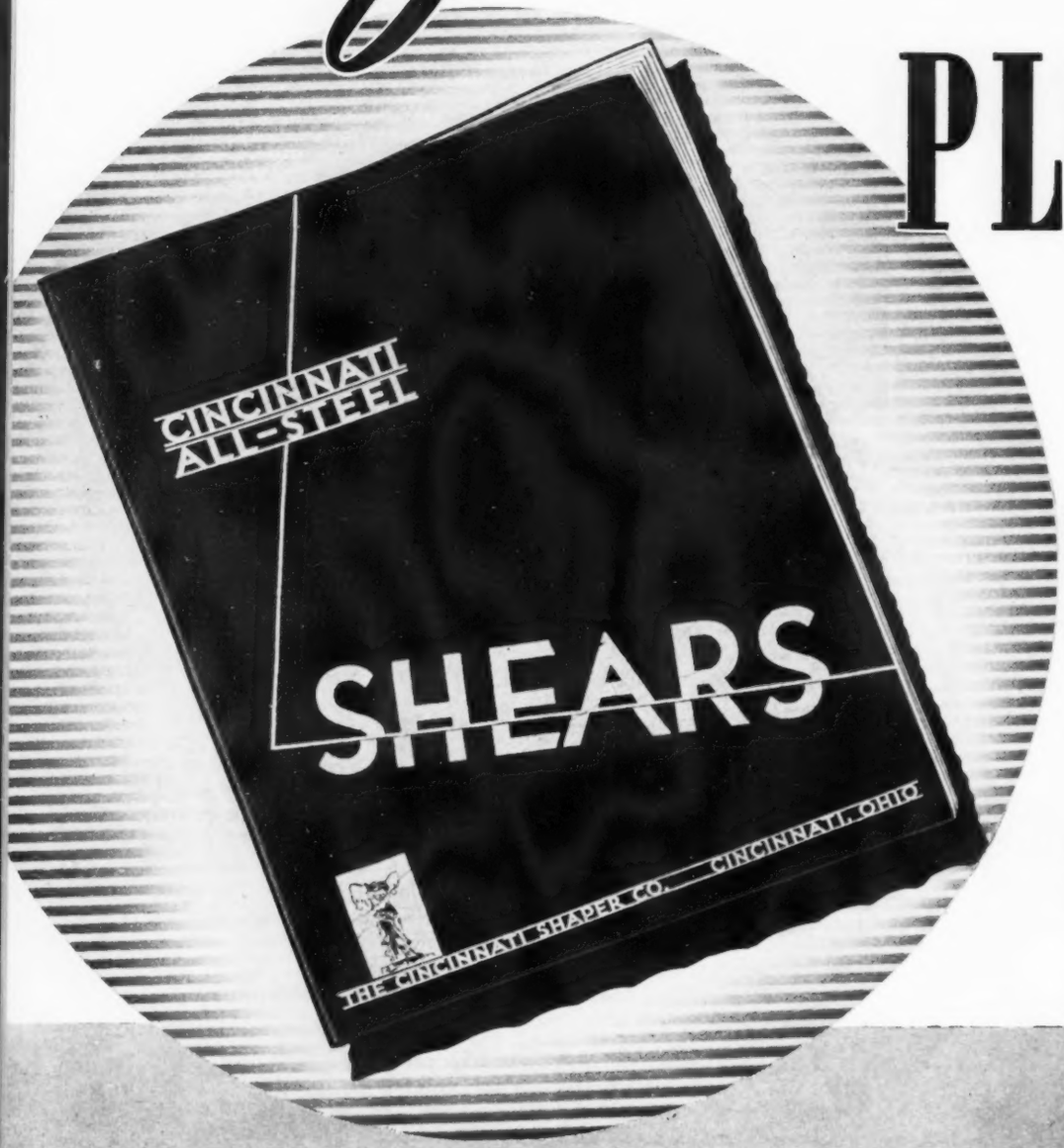
WELDING AND FORGING

Reference Book Sheets in this issue are both based on studies made by the Vega Aircraft Corporation. One of them shows the use of expansion guns in connection with welding jigs. A second tells of the advantages and limitations of hot and cold pressed forgings. While these pages are based on aircraft practice, they apply to all branches of the metal-working field. Pages 1123 and 1125.

COMING

Republic Aircraft Company's *Thunderbolt* has intrigued the nation's imagination with its high speed and high altitude performance. An early Armament Section will tell how this ship is being built. Special emphasis will be given the construction of the jigs on which the production program is based.

Information PLEASE



Accurate information is an invaluable guide to the selection of equipment.

This heavily illustrated catalog covers the complete line of Cincinnati All-Steel Shears.

- . . . includes data and dimension sheets.
- . . . descriptions of standard and optional equipment.
- . . . completely illustrated details of Cincinnati construction.

MAIL THIS COUPON TODAY

The Cincinnati Shaper Co.
CINCINNATI, OHIO

Please send me the Cincinnati All-Steel Shear Catalog S-2.

Name_____

Company_____

Address_____

THE CINCINNATI SHAPER CO.

SHAPERS • SHEARS • BRAKES

CINCINNATI, OHIO

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

★ Metal Show ★

THE BATTLE OF METALS

MEN AND METAL WILL WIN THE WAR.

Men have to be trained for military service. Metal has to be converted into war machines without which men are powerless in modern battle.

Men must be assigned to particular duties and transported to far-flung fronts. Metal must be conserved and employed effectively if it is to yield the maximum number of tanks and planes and guns.

To do this we must banish waste and enlist improved manufacturing techniques. We must put to work steels with lowered alloy contents in place of the generously alloyed analyses of our more affluent days. Aluminum, magnesium, bronzes and the other metals so vital to war industries need better processing to get the most out of our limited stocks.

We must adopt a wartime metallurgy and wartime shop practices. Above all we must exchange our findings freely so that each of us may profit by the errors and the experiences of others working toward the same goal. For we have a common job to do and the sooner it is done, the better.

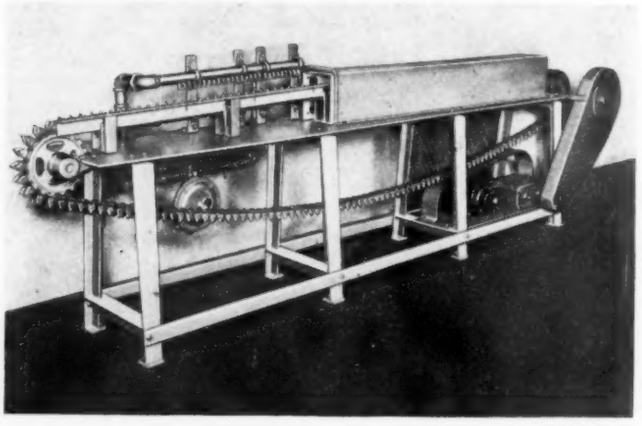
The National Metal Congress, and the Exposition that goes with it, provide an opportunity to give and take the results of technical research and shop experience. New metals, new processes and new equipment are all part of the program. Increased output is the keynote and winning the war the ultimate objective.

Our men are fighting in many lands. Let us back them up 100 percent in this battle of metals.

SHOW IN PRINT

New Equipment, accessories and materials on display at the National Metal Show in Cleveland, Ohio, Oct. 12–16

AMERICAN GAS HEAT-TREATER



Illustrated is one of a variety of continuous machines for annealing, hardening, or heating tubes, bolt heads and threads, and similar parts in open air-gas flames. It was designed for use in the mouth annealing of 20 and 37 mm. steel cases.

Simple in design and operation, the cases are rolled along tracks by fingers on an endless chain. After passing between fishtail burners in a manifold, firing from top and bottom, the cases pass into an insulated hood which slows down the cooling process and results in a thoroughly and uniformly annealed piece. The burners may be adjusted to suit many sizes of work and the heat input may be varied at will through a wide range. The conveyor is driven by a variable speed transmission to give varying heating time.

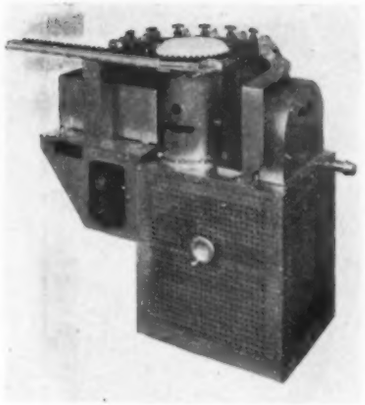
Other machines are made with various modifications including heating two ends of tubes at one time with tilting conveyor plates to quench. Production begins the moment the burner is lighted. There is no furnace heating time.

AJAX "DEEP-CASE" CARBURIZING FURNACE

Cases up to $\frac{1}{8}$-in. depth are produced by a deep-case carburizing furnace developed by the Ajax Electric Co., Inc., Frankford at Delaware Ave., Philadelphia, Pa. The method permits quenching directly from the bath, or transfer to baths maintained at quenching temperature, thus eliminating the need to reheat for hardening. The immersion process is said to give freedom from uneven heating, distortion, soft spots, or decarburization.

Utilizing the electromagnetic effect between pairs of closely-spaced electrodes, and thus heating while simultaneously circulating the cyanide salts, the furnace holds temperatures unvarying by 5 deg. at approximately 1,750 F. The furnaces are equipped with round or rectangular parts, automatic temperature controls, and step-down transformers. Sizes range from 35 to 750 kw. rating, with pots from 10 in. diameter to 20 ft. in length.

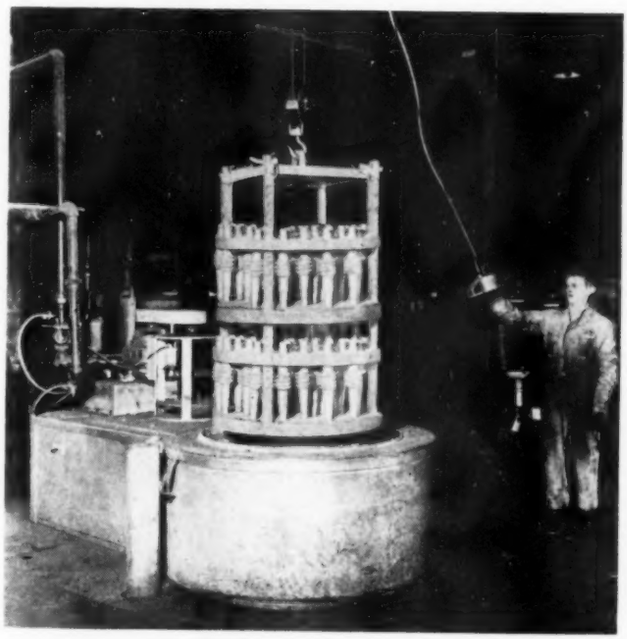
SELAS AUTOMATIC HEAT-TREATING



Typical of machines for selective heat-treatment which utilize only premixed gas and air for fuel, is the unit built by the Selas Company, Erie Ave. and D St., Philadelphia, Pa., for localized hardening of airplane pushrod balls.

The parts are carried around a rotating disk by peripheral friction, and are exposed to "superheated" combustion. They drop into the quench tank after three-quarters of one circuit. Burners are refractory lined to attain extreme concentrations of heat-liberation in a small combustion space. The rotating disk is refractory-topped for protection and re-radiation of heat to work-pieces from the side opposite the burners. Each work-piece rotates as it rolls, bearing-fashion, and makes four revolutions while in front of the burner line. Drive-speeds and burner-positioning are adjustable to provide for any degree of heat localization and heat penetration desired. In one case, the ball end of a part was hardened at 1,525 F. without hardening interior recesses of the shank cylinder.

LINDBERG FORCED CONVECTION FURNACE



A forced convection furnace with heating capacity to 1750 F., has been developed by the Lindberg Engineering Co., 2450 W. Hubbard St., Chicago, Ill., known as the Super Cyclone. Heat is forced under pressure by a high velocity fan through every part of the charge. This completely eliminates radiation to the work from a source hotter than the desired work temperature, and does away with one-sided heat which may strain, distort or pull the work out of shape.

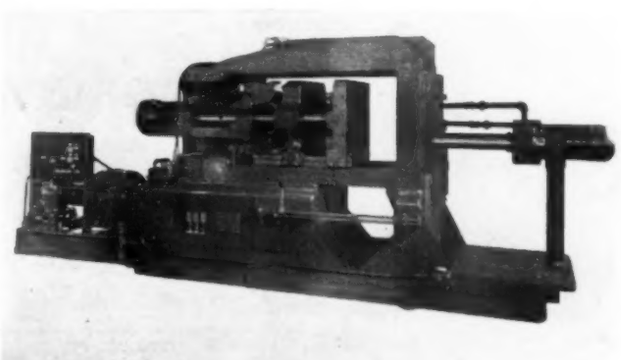
Heating is by gas, oil or electricity. The circulating fan is in a separate chamber away from the work chamber where it is safe from damage that might result from careless handling in loading or unloading operations. The fuel fired Super Cyclone consists essentially of work chamber, fan chamber and combustion chamber. The electric Super Cyclone has the work chamber, the fan chamber and the element chamber which contains the nickel-chromium Tubulaire heating element.

All parts subjected to high temperatures—the fan and fan shaft, the air ducts—are of nickel-chromium heat-resisting alloy. The furnace is made in 20 standard models.

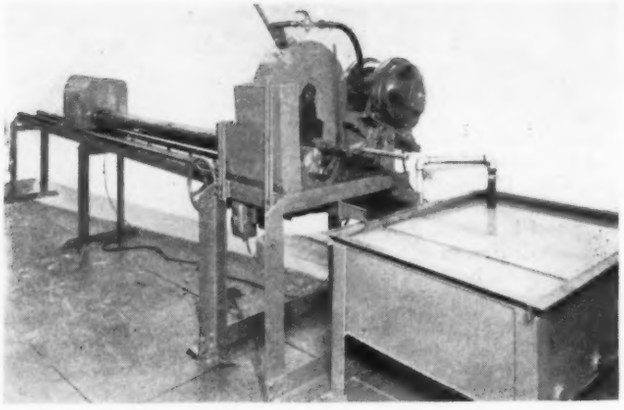
LESTER-PHOENIX DIE CASTING MACHINE

Injection pressures up to 22,000 lb. per sq.in. are utilized in the improved model die casting machine introduced by Lester-Phoenix, Inc., 2711 Church Ave., Cleveland, Ohio. Since injection pressure can only be applied to the extent that it can be confined to the die cavities, the machine has a heavy beam-type frame.

Automatic electric timers control injections, die movement, and automatic ejection cycles, insuring accurate repetition of established cycles.



CRONITE ABRASIVE CUT-OFF MACHINE



Rotation of the work eliminates the long arc of contact encountered when cutting large diameters with the bar stationary in an abrasive cut-off machine built by the Cronite Co., New York, N. Y. The machine will handle work up to 7½ in. in diameter, and 12 ft. long. Cut pieces can be any length from ¼ in. up. It will be shown in Booth D-323 by the Manhattan Rubber Mfg. Division.

Coolant is supplied at a rate of 25 gal. per min., from a tank holding 125 gal. The tank is separate from the machine for easy removal with a lift truck. Cutting wheel size is 20 × ⅛ × 1½ in.

MORRISON CONVECTION FURNACES

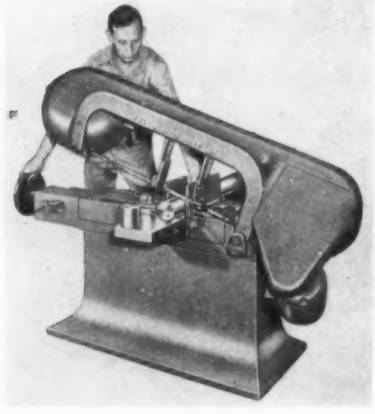
Temperature uniformity within 5 F. in any part of the chamber is obtained in high temperature forced convection furnaces built by the Morrison Engineering Corp., 5005 Euclid Ave., Cleveland, Ohio. The work is completely shielded from radiation of any hot surface making such precision possible.

All furnaces are constructed of low heat-absorbing material, and with air being the only heating medium, temperatures can be changed from low to high, or high to low almost immediately. Both the electric and fuel fired units are equipped with an air-flow switch which provides protection to the heating units against electric power failure, or belt breakage.

Spiral flow ducts of streamline design reduce air friction to a minimum and force all of the air through the work in an upward direction. Large pressure blower-type fan of sufficient size to force a large volume of air under high pressure through dense loads is used. The high speed of the air under positive pressure results in uniform heating from bottom to top, when coming up to temperature, and practically no temperature difference when on control. For 1,250 F. the fan wheel and housing are constructed of heavy heat-resisting alloy designed with a wide margin of safety.

TRENT ELECTRIC AIR CONVECTION FURNACE

Forced air convection furnaces are built in either pit or box-type with a temperature range from 300 to 1400 F. in a variety of sizes by the Harold E. Trent Co., Leverington Ave. and Wilde St., Mannayunk, Philadelphia, Pa. Heating elements of nickel chromium alloy operate at low watts per square inch on either 110, 220 or 440 volts, without transformers. They are mounted in a plug which can be readily removed for cleaning and inspection. The charge to be heat-treated is loaded into a separate chamber isolated from the heating chamber by a wall of insulation. The hot air is circulated from one chamber to the other by a powerful blower. Illustrated is an 18 in. diameter by 18 in. deep air-recirculating furnace rated at 18 kw. on 230 volts, three-phase complete with all control equipment. It is used for drawing parts in production lots.



WELLS METAL-CUTTING SAW

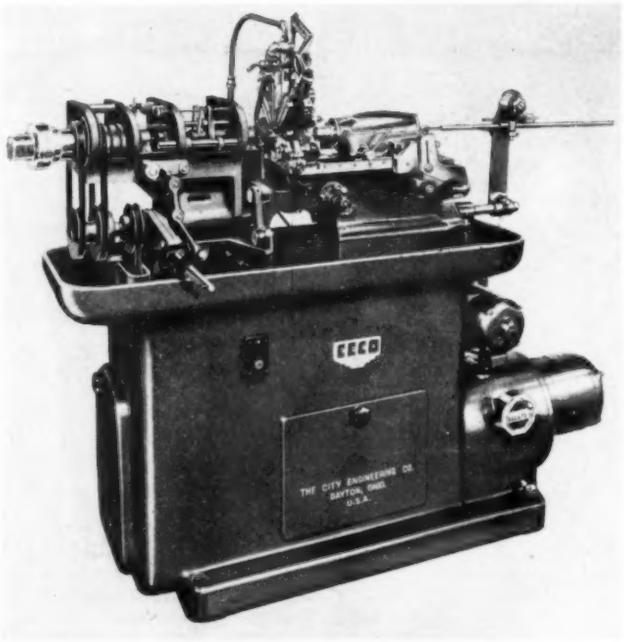
The Wells Manufacturing Corp., Three Rivers, Mich., announces the No. 80 metal-cutting saw. This has a capacity for rectangular work 8 × 16 in., or when equipped with special bowed guides, 5 × 24 in. Round work to 8-in. diameter can be handled. The saw operates at 60, 90, 130 ft. per min. The vise will swivel to 45 deg. The ½ hp. motor operates the saw through a V-belt drive.

RADIAC CUT-OFF MACHINE

The Type "J" Radiac cut-off machine built by A. P. de Sanno & Son, Inc., Phoenixville, Pa., is a compact unit designed for fast, economical and accurate cutting of bars, tubing and form shapes. The use of a coolant increases wheel life, minimizes burr, and reduces cutting heat. As vibration is an important cause of excessive wheel wear, rigid construction is a feature of the machine.

Coolant is supplied from a storage tank and pump located in the base of the machine. The machine is equipped with a patented, quick-acting, hand-operated device. The work is held on both sides of the cut, under spring tension. The hand lever is used when locating or removing work from the vise. Vise may be supplied with the machine for making straight or angle cuts.

"CECO" SWISS TYPE AUTOMATIC SCREW MACHINE



Two new models of the "Ceco" Swiss type automatic screw machine have been built by the City Engineering Co., Dayton, Ohio. The new machines have round bar stock capacity of $\frac{3}{8}$ in. and $\frac{1}{2}$ in. Among the improvements incorporated in the machines are the inclusion of five radial tool slides.

The turning capacity in length is 4 in. without resorting to the use of a bell cam for the feed motion of the headstock. All headstock movements are controlled by a flat cam due to an increase in the latter's diameter to approximately 11 in. and a new type feed lever mechanism.

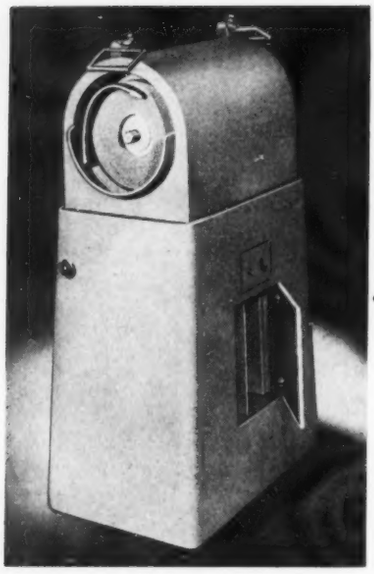
The kinematic layout of the feed lever mechanism is such that the feed cam has a constant rise for turning straight tapers. This simplifies the cam layout and the making of the cam.

The combined three-spindle attachment for spot centering, drilling and tapping or threading, is capable of threading and tapping left-hand as well as right-hand threads. The drilling capacity is 2 in. in depth, the threading capacity in steel is $\frac{1}{4}$ in., and in brass is $\frac{5}{16}$ in.

THOR ELECTRIC DRILL

Light in weight and developing twice the power of ordinary, similarly rated, production-duty electric drills are the Thor U14F $\frac{1}{4}$-in. drills announced by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.

Particularly useful in limited space or in unusually difficult positions, these drills have the power reserve and construction ruggedness necessary for high speed production. They are available in speeds of 2500, 3750, and 5000 r.p.m. They can be provided with either pistol-grip handle with trigger switch, or side handle with momentary trigger switch. Both types can be used for either intermittent or continuous drilling, and are adaptable for production jobs.



BUEHLER WET POWER GRINDER

A ¾-hp. wet grinder has been built especially for coarse and medium-coarse grinding in the metallurgical laboratory by Adolph I. Buehler, 228 N. La Salle St., Chicago, Ill. The coolant supply to each wheel is controlled separately. The recirculating cooling system is housed in the base. The tank pedestal is equipped with a cabinet for extra wheels and tools.

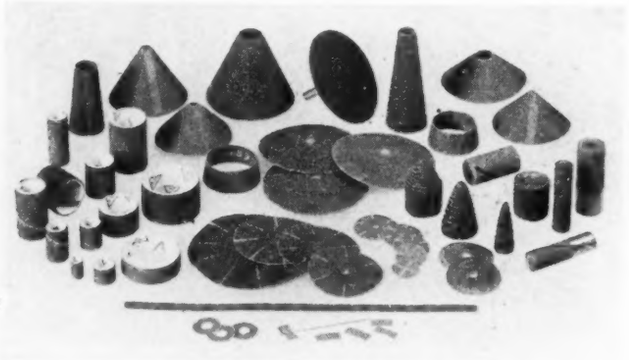
Special wheel guard design leaves the entire side-surface of the 12-in. steel-backed wheels exposed, giving a wide range of surface speeds and at the same time providing protection for the operator. The grinder is free from oscillation and vibrating of grinding wheels.

RANSOHOFF PARKERIZER

A continuous drum-type parkerizing unit is built by N. Ransohoff, Inc., Cincinnati, Ohio. The machine eliminates manual labor in putting work through the processes of parkerizing, rinsing, chromic acid rinsing, blow-off, oil dipping and baking. The patented drum is so constructed that it holds a level of liquid within approximately 3 in. of the center at the same time allowing room for the work to enter and discharge at the ends. It permits constant circulation between the drum and the heating tank to maintain the required temperature of the liquid in the drum.

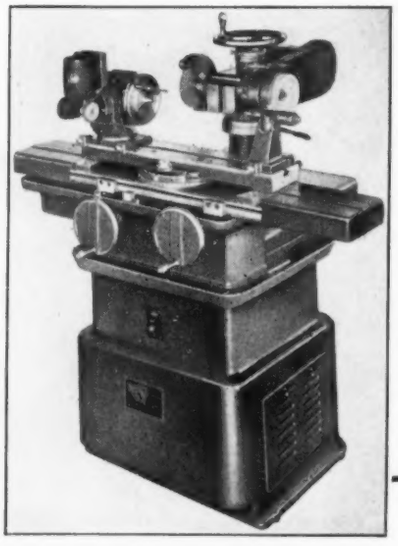
BEHR-MANNING COATED ABRASIVES

Sandpapering operations that require minutes to perform by hand, can be done in seconds with coated abrasive specialties manufactured by Behr-Manning Corp., Troy, N. Y. These Spiracords, Spirabands, Spirabelts, Spirapoints, Cones, Disks and pencils, of Metalite Cloth are used on portable tools.



VERNON TOOL AND CUTTER GRINDER

The Vernon universal tool and cutter grinder, announced by the Machinery Manufacturing Co., 1915 East 51 St., Los Angeles, Calif., handles all types of tools, cutters, cylindrical work, and internal jobs within the capacity of the machine. The spindle head is powered by a ½-hp., 60-cycle, 3-phase, ball bearing motor of 3450 r.p.m. The 2-in. O.D. spindle is mounted in anti-friction bearings and has a ⅝-in. shaft size at the wheels. The internal spindle is of similar construction but designed for the higher speeds required by smaller wheel sizes. Three external and two internal speeds are provided.



The internal auxiliary drive, substituted for external spindle when doing internal grinding, eliminates unnecessary wear on the external spindle assembly. Grinding speeds are varied by changing the motor pulleys only for external spindle work, and by changing intermediate arbor pulleys only for internal grinding. This method of speed control eliminates possible brinnelling of the precision bearings by thoughtless tapping of the pulleys in place on the spindles. Connecting belts and external grinding wheels are guarded.

The spindle head swivels 360 deg. on the column in a horizontal plane and is provided with two suitable locks which rigidly hold the swiveling head in position. A single control locks the column's vertical position.

The column is well protected against all abrasives and splash by an accordion neoprene boot.

Table longitudinal movement is applied through a V-belt which is adjustable for both stretch and tension. Table movement is imparted through the handwheel on the front right side of the machine, and, for convenience by a smaller handwheel at the rear of the grinder.

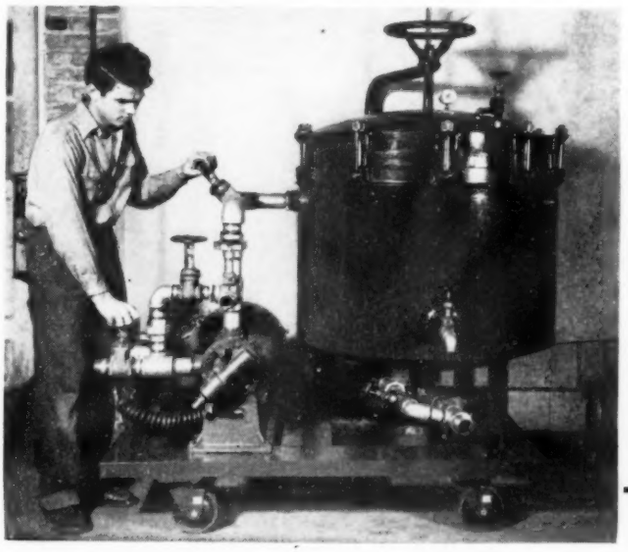
Centers swing 10½ in. diameter over table. Maximum longitudinal travel is 17¾ in. Maximum work length between right- and left-hand tailstocks, 16 in. Maximum work length between headstock and tailstock, 13½ in. Maximum distance between centerline of work and centerline of grinding wheel spindle, 10 in. Transverse travel of column, 7½ in. Vertical movement of wheel spindle, 6 in.

VERNON VERTICAL MILLING HEAD

A milling head with integral motor drive and speed reducer, especially designed for use on the Vernon No. 0 milling machine has been announced by the Machinery Manufacturing Co., 1915 East 51 St., Los Angeles, Calif. The head is rigidly supported on the Vernon mill overarm and may be reversed, using the motor on either side. This extends the range of useful table travel approximately 3 in.

Complete 360-deg. rotation can be made in the vertical longitudinal plane, and settings can be duplicated by referring to the graduated dials, which are included on both ends of the overarm housing. The transverse swivel rides on a 3-in. pilot and can be rotated 25 deg. each side of vertical. Graduations 30 deg. each side of zero setting are accurately cut on the spindle housing. Each angular setting of the head is locked by two large, hardened socket-head cap screws. Squaring faces on the spindle housing are provided for vertical positioning of the spindle in both planes. The head is equipped with special collet for quick ejection of cutters and tools. Collet sizes are $\frac{1}{4}$, $\frac{3}{8}$, and $\frac{1}{2}$ in. Special sizes from $\frac{1}{8}$ to $\frac{7}{16}$ in. by 16ths are available. All belts and pulleys are fully guarded.

SPARKLER HORIZONTAL PLATE OIL FILTER



To meet today's conservation needs a filter for reclaiming oils such as cutting, grinding, lube, hydraulic and transformer has been announced by the Sparkler Mfg. Co., Mundelein, Ill. The filter is entirely portable for use at the machine, or for batch filtration where reclamation is desired at a central location.

The Sparkler filter is adapted for use with either paper, cloth, disk, or diatomaceous earth (filter powder) and models are available with capacities ranging from 5 to 10,000 gal. per hr. The plates are designed for deep cake space which makes for fewer cleanings and long cycles of uninterrupted service.

CASTOLIN WELDING ALLOYS AND FLUXES

A line of welding rods and fluxes is now offered by Eutetic Welding Alloys, Inc., 40 Worth St., New York, N. Y., for the low temperature welding of a wide variety of metals. Rods are supplied in 36 different analyses for use on cast iron, steel, bronzes, nickel, monel, aluminum, magnesium and even zinc base die castings. They are furnished in a range of sizes up to $\frac{3}{8}$ in. diameter. A flux is designed for use with each.

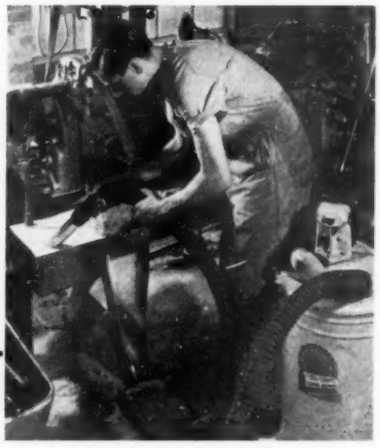
While the technique of using these alloys is similar to that for brazing the resulting joint is harder, stronger and more nearly like the parent metal in color and physical characteristics. The parent metal is not fuzed because of the fact that operating temperatures are well below its melting point which avoids localized hardening or grain growth in the work being welded. Consequently welded sections can be machined without difficulty.

Heat may be applied by means of the oxyacetylene torch, by arc-welding methods, by the use of the carbon arc, or by use of a furnace. The Castolin process is suitable for three major functions; the reclamation of spoiled or defective castings, the salvaging of broken tools and the fabrication of new machine parts.

CARSON ELECTRONIC MICROMETER

Highly sensitive electron tubes replace the operator's judgment in the electronic paper thickness tester built by Instrument Specialties Co., Inc., Little Falls, N. J. Thickness can be accurately tested to 0.0001 in. The unit is portable, weighs but 20 lb., and does not have to be level to operate.

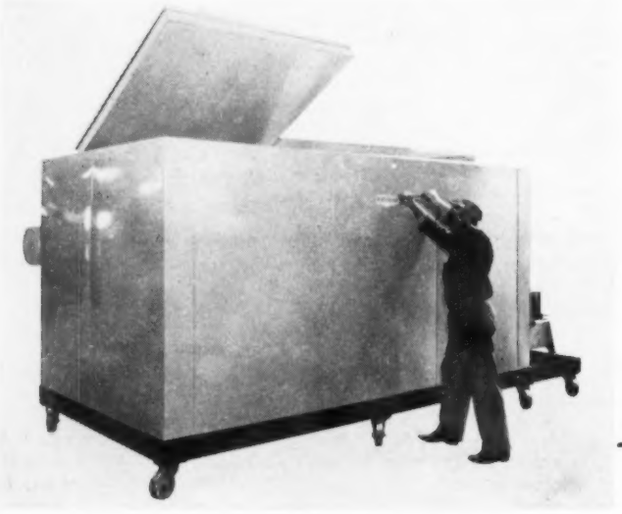
The lower anvil is retracted by a lever at the side of the base, allowing work to be inserted and removed without moving the dial. Upper anvil holds work against lower anvil under constant and predetermined contact pressure while measurements are being made. With work in place between the jaws, the dial is rotated to the reading point as indicated by bullseye in the base which automatically lights on contact. Dial adjustment to "flicker on and off" position gives final correct dial setting. Standard radio tubes are use in the electronic controlled unit.



HILD PORTABLE VACUUM MACHINE

Draining the cutting oil from the reservoir of metal-working machines, when it is necessary to change or reclaim the coolant, may be done with the portable vacuum machine built by the Hild Floor Machine Co., 1313 W. Randolph St., Chicago, Ill.

Powerful suction of the machine and the large diameter of the hose are adapted for drawing out the cutting oil quickly, and with it most of the metal cuttings and sludge. It has been found that a barrel of coolant can thus be removed in 10 to 15 min., leaving on the bottom of the tank only the heavier waste which can be scraped out.



KOLD-HOLD STORAGE CABINET

Portable sub-zero aluminum sheet storage cabinets are built in several sizes by the Kold-Hold Manufacturing Co., 424 N. Grand Ave., Lansing, Mich. Inside dimensions of the cabinet illustrated are approximately 5×5×12 ft. All machines are obtainable in temperatures ranging from zero to —45 F. Counterbalanced top-opening lids or end doors are optional.

TAGLIABUE SELF-BALANCING INDICATOR

A self-balancing indicator for taking a great many temperature readings in a minimum time without errors resulting from fatigue, has been developed by C. J. Tagliabue Mfg. Co., Park and Nostrand Ave., Brooklyn, N. Y. With the fastest model readings can be taken every few seconds. A hair-line indicator designed to minimize parallax increased the readability.

An "in balance" signal light is provided which lights while the indicating carriage is travelling from one point to the next, flickers, while it steps into accurate balance, and stays out when it is time to take the next reading. If more than twelve points are required, a separate switch box of the same design as the instrument case can be supplied for an almost unlimited number of points. A special arrangement of internal scale lighting can be supplied.

EXHIBITORS

NATIONAL METAL EXPOSITION

CLEVELAND PUBLIC AUDITORIUM, CLEVELAND, OHIO, OCT. 12–16, 1942

(Booth number follows company name)

Acme Electric Welding Co. (A-500). Spot, butt, flash, seam welders.

Advance Polishing Wheels, Inc. (E-113). Polishing and buffing wheels.

Agfa Ansco Div., General Aniline & Film Corp. (C-238). Industrial X-ray Equipment.

Alloy Castings Co. (B-502). Valves, fittings and parts.

Alox Corp. (B-516). Corrosion preventive compounds and lubricating materials.

Aluminum Co. of America (C-421). Aluminum alloys and products.

Aluminum Ore Co. (C-421). Alorco activated alumina and apparatus.

Alvey Ferguson Co. (S-162). Conveyors, washing machines.

American Brake Shoe & Foundry Co. (A-525 and B-320). See American Manganese Steel Div.

American Brass Co. (A-321). Welding rods, brass and special alloy products.

American Car & Foundry Co. (B-314). Automatic rivets and bar heaters.

American Foundry Equipment Co. (D-340). Blast cleaners.

American Gas Furnace Co. (B-103). Heaters, furnaces and appliances.

American Machine and Metals, Inc. (A-418). Riehle testing machines.

American Magnesium Corp. (C-421). Magnesium alloys.

American Manganese Steel Div. of American Brake Shoe & Foundry Co. (A-525). Heat-resisting castings and containers, Hoffman Flexbox sectionalized container and welding materials.

Ampco Metal, Inc. (B-131). Forged and extruded bar stock, castings, rough and machined parts and welding rods.

Anderson & Brown Co. (B-137).

Anderson & Sons (B-421).

Andresen, Inc. (B-210).

Armstrong Cork Co. (D-138). Fire bricks and cement.

Atlas Foundry Co. (B-320).

Atlas Steels, Ltd. (D-113). Castings.

Automatic Temperature Control Co., Inc. (E-117). Valve operators, high-temperature control systems, position indicators and temperature controllers.

Babcock & Wilcox Co. (C-325). Refractories.

Baker & Co., Inc. (B-415). Platinum laboratory equipment, chemical equipment, thermocouples, protection tubes, atmospheric furnaces and platinum resistance coalash analysis furnace.

Banner Iron Works (B-320). Castings.

Barnett Foundry & Machine Co. (B-320). Castings, patterns, and special machinery.

Bastian-Blessing Co. (C-131). Welding torches, rods and electrodes.

Bausch & Lomb Optical Co. (D-150). Optical instruments.

Behr-Manning Corp. (C-141). Polishing lathes, abrasive cloth belts and attachments for portable sanding and finishing tools.

Black Drill Co. (D-146). Hardsteel drills.

Brickseal Refractory Co. (A-509). Furnace refractories.

Bridgeport Brass Co. (D-411). Brass and copper.

Charles Bruning Co., Inc. (A-411). Drafting and surveying equipment and supplies.

Brush Development Co. (B-142). Meter for testing surface smoothness and oscillographs.

Adolph I. Buehler (E-111). Cutters, grinders, polishers, and matching presses for metallurgical samples.

H. W. Butterworth & Sons Co. (B-320). Rough and finished castings.

Canadian Radium & Uranium Corp. (S-130). Equipment used in making radiographs.

Carboloy Co., Inc. (B-324). Cemented carbides.

Carborundum Co. (C-122). Abrasive products.

Catskill Metal Works, Inc. (A-514). Abrasive cut-off machines and portable power reaming machines.

Chase Brass & Copper Co. (B-327). Brass and copper products, welding rods and alloys.

Chemical Rubber Co. (B-520).

Chicago Flexible Shaft Co., Stewart Industrial Furnace Div. (E-114). Heat-treating furnaces.

Chicago Steel Foundry Co. (L-102. Carbon and alloy steel castings.

City Engineering Co. (D-310). Swiss type automatic screw machines.

Cleveland Graphite Bronze Co. (C-322). Burnishings.

Cleveland Tapping Machine Co. (A-309). Automatic tapping machines.

Climax Molybdenum Co. (A-501). Molybdenum steels and irons.

Commerce Pattern Foundry & Machine Co. (B-424). Castings.

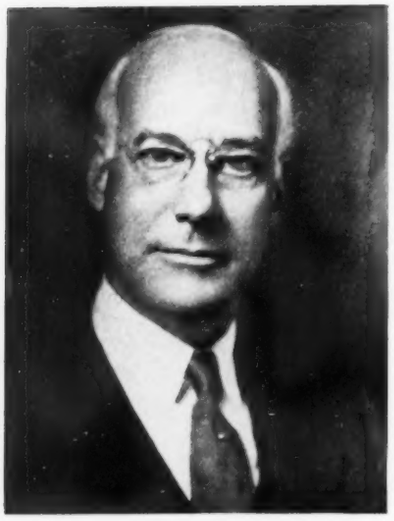
Continental Industrial Engineers, Inc. (C-133). Heat-treating furnaces.

Continental Machines, Inc. (B-141). Contour saws, files, polishers and surface grinders.

R. W. Cramer Co., Inc. (C-424). Timing devices and controls.

Crown Rheostat & Supply Co. (A-310). Plating machinery and supplies.

Visit AMERICAN MACHINIST'S Booth E-137



AMERICAN SOCIETY FOR METALS

Bradley Stoughton, retiring president of the American Society for Metals, former dean of engineering at Lehigh, served in Washington during the last war and is now Chief, Heat-Treating Equipment Unit, Tools Section, War Production Board

H. J. French, president-elect, is Senior Consultant in the Metallurgical and Specifications Sections of the War Production Board. He was in charge of alloy steel and iron development for International Nickel

Darwin & Milner, Inc. (C-118). Tool steels.

Deepfreeze Div. of Motor Products Corp. (A-401). Chilling units.

Delaware Tool Steel Corp. (A-325). Tool steels, pneumatic and hand tools.

A. P. de Sanno & Son, Inc. (B-431). Abrasive cut-off machines.

Despatch Oven Co. (A-415). Gas-heat-treating furnaces.

Decto Scale. (C-232).

Detroit Rex Products Co. (D-311). Degreasing and cleaning machines.

Harry W. Dietert Co. (A-410). Spectographic equipment for analysis of metal, carbon and sulphur determinators and sand testing equipment.

DoAll Cleveland Co., Inc. (B-141). Contour saws, files, polishers and surface grinders.

Dow Chemical Co. (B-111). Magnesium alloys, castings, sheets, strip and plate, extruded shapes, bars, rods and forgings, fabricated parts.

E. I. du Pont de Nemours & Co. (D-134).

Duraloy Co. (B-110). Steel alloy castings.

Eastman Kodak Co. (A-318). Industrial radoigraphs and Kodachrome photographs of factory processes, industrial X-ray film, intensifying screens, processing chemicals and accessory equipment.

Eisler Engineering Co. (A-500). Spot, butt and arc welders.

Elastic Stop Nut Corp. (A-424). Self-locking nuts.

Electro Refractories & Alloys (D-315). Refractory material.

Electroloy Co., Inc. (A-500). Welding electrodes.

Eutectic Welding Alloys Co. (E-140). Alloys for low temperature welding.

Experimental Tool & Die Co. (B-511).

Expert Welder Co. (A-500). Welders.

Farrel-Birmingham Co. (B-320). Gears and couplings.

Federal Machine & Welder Co. (A-500). Electric spot, butt, projection and seam welders.

Federal Products Corp. (B-401). Inspection gages.

Firth-Sterling Steel Co. (C-150). Lathe tools, end mills, milling cutters, counterbores, drills, specialty tools, dies and steels.

Florence Pipe Foundry & Machine Co. (B-320). Hydraulic presses.

J. B. Ford Co. (C-117). Cleaning and washing compounds.

Fulton Foundry & Machine Co. (B-320). Castings.

General Alloys Co. (C-146). Heat and corrosion resistant alloys, containers and parts for heat-treating furnaces.

General Electric X-ray Corp. (E-130). Industrial X-ray machines.

General Foundry & Manufacturing Co. (B-320).

Globar Div. of Carborundum Co. (C-122). Electric heating elements.

Globe Machine & Stamping Co. (B-335). Coupling barrels, sheet metal stampings and dies.

Claud S. Gordon Co. of Ohio (E-102). Heat-treating furnaces.

Gray Machine Co. (S-124). Cutting and nibbling machinery.

Gray-Mills Co. (B-418). Coolant pumps.

Great Lakes Steel Corp. (S-150).

Greenlee Foundry Co. (B-320). Grey iron and Meehanite castings.

Gulf Oil Corp. (A-329). Quenching and cutting oils.

H & H Research Co. (C-242). Portable electric tools.

Hamilton Foundry & Machine Co. (B-320). Castings.

Hamilton Tool Co. (D-310). Swiss type gear hobbing machines.

Hammond Machinery Builders, Inc. (D-122). Tool grinders, belt surfacers and polishing lathes.

Handy & Harman (D-314). Brazing solders.

Heil & Co. (A-332). Chemical resistant tanks and tank heating units.

Hevi Duty Electric Co. (D-142). Laboratory equipment.

Hild Floor Machine Co. (C-324). Electric floor scrubbing machines and industrial vacuum machines.

A. F. Holden Co. (B-147). Heat-treating.

W. J. Holliday & Co. (C-315). Speed case and speed treat steels.

E. F. Houghton & Co. (D-137). Rust-preventive coatings, cutting oils, carburizers, drawing compounds, lubricants and leather packings.

Illinois Testing Laboratories, Inc. (E-133). Indicating pyrometers, resistance thermometers, controllers and air velocity meters.

Independent Pneumatic Tool Co. (C-314). Portable electric drills, screwdrivers, nut setters, grinders, sanders, saws, hammers and nibblers.

Instrument Specialties Co., Inc. (C-335). Coil and flat springs and electronic micrometers.

International Nickel Co., Inc. (C-111). Nickel and its alloys.

C. Walker Jones Co. (B-524). Work, heat-resisting and flameproof gloves, coveralls, helmets, curtains and fire blankets.

Kanawha Manufacturing Co. (B-320).

J. W. Kelley Co. (C-336).

AMERICAN WELDING SOCIETY

Col. G. F. Jenks, U. S. Army, is retiring as president of the American Welding Society after having served in the post for the past two years. He is chairman of the Industrial Research Division of the Welding Research Committee

K. L. Hansen, after serving for two years as first vice president, has been chosen president. He is Consulting Electrical Engineer, Harnischfeger Corporation, and has been active in the Section Advisory Committee of the Society

---

Kelley-Koett Manufacturing Co., Inc. (E-114). Industrial X-ray equipment.

Andrew King (B-118). Consulting engineer.

Kinney Iron Works (B-320). Castings.

Koehring Co. (B-320).

Kold-Hold Manufacturing Co. (E-130). Refrigerator pressure units and cold storage bins.

Krouse Testing Machine Co. (C-420). Testing machines.

Lepel High Frequency Laboratories (D-328). High frequency converters.

Lester Engineering Co. (A-341). See Lester-Phoenix, Inc.

Lester-Phoenix, Inc. (A-341). Die casting and injection molding machines.

Lindberg Engineering Co. (B-146). Heat-treating furnaces.

Lukens Steel Co. (C-340).

Machinery Manufacturing Co. (D-335). Milling machines, jig borers and grinders.

Magnaflux Corp. (A-320). Magnetic inspection equipment.

Magnetic Analysis Corp. (D-327). Magnetic inspection equipment.

Mahr Manufacturing Co. (D-418). Heat-treating furnaces.

Mall Tool Co. (D-321). Portable power tools and flexible shaft machines for grinding, sanding, polishing and drilling.

P. R. Mallory & Co., Inc. (A-500). Non-ferrous alloys, electrical contacts and welding electrodes.

Manhattan Rubber Manufacturing Co. (D-323). Abrasive cut-off machines and wheels.

Marquette Manufacturing Co. (A-315). Welders and welding supplies.

Martindale Electric Co. (B-114). Dust masks, rotary files and burrs.

Matchless Metal Polish Co. (E-113). Polishing compound.

Mazlo Magnesium (C-421). See Aluminum Co. of America.

McKenna Metals Co. (C-110). Carbide cutting tools, blanks, parts and boring tools.

Meehanite Research Institute of America (B-320). Meehanite metal castings.

Minnesota Mining & Manufacturing Co. (B-340). Abrasive belt swing grinders and backstand idlers.

Molybdenum Corp. of America (D-111). Alloy and chemicals of molybdenum, tungsten and boron.

Monarch Steel Co. (C-315).

Morrison Engineering Co. (A-414). Burnishers and special equipment.

Morse Magneto Clock Co. (A-511). Watchmen's clocks.

Motor Products Co. (A-401). See Deepfreeze Div.

Multi-Hydromatic Welding & Mfg. Co. (A-500). Automatic welding equipment.

National Electric Welding Machine Co. (A-500). Electric welding equipment.

National Machine Works (B-130). Industrial gas apparatus.

National Machinery Co. (A-335). Bolt and nut machinery.

National Refining Co. (A-420). Petroleum products.

Niagara Blower Co. (C-428). Heat exchangers and condensers.

Nicholson File Co. (C-320). Files.

Norton Co. (C-138). Abrasive products and grinding wheels.

Oakite Products, Inc. (E-134). Cleaning compounds.

Ohio Carbon Co. (C-328). Burnishers, brushes and contacts.

Ohio Crankshaft Co. (A-324). Induction hardeners.

Ohio Seamless Tube Co. (D-110). Seamless and electric welding steel tubing.

Osborn Manufacturing Co. (B-427). Foundry molding machinery.

Pangborn Corp. (C-130). Blast cleaning and dust control equipment, cleaning barrel and tables.

Park Chemical Co. (S-112). Polishing materials.

Parker-Kalon Corp. (B-134). Screws and fasteners.

Henry Perkins Co. (B-320). Nail machinery.

Phillips Metalix Corp. (B-337). Industrial X-ray equipment.

Phillips Manufacturing Co. (C-327). Metal cleaning machines.

Phoenix Machine Co. (A-341). See Lester-Phoenix, Inc.

Picker X-Ray Corp. (B-122). Industrial X-ray equipment.

Pittsburgh Pipe Cleaner Co. (A-431). Pipe and tube cleaning machines and accessories.

Pohlman Foundry Co. (B-320). Grey iron castings.

Porter-Cable Machine Co. (A-519). Wet belt machining and shapers.

Precise Tool & Manufacturing Co. (A-311).

Progressive Welder Co. (A-340 and A-500). Welding equipment, punching units and riveters.

Radium Chemical Co., Inc. (B-504). Radiograph equipment.

N. Ransohoff, Inc. (B-311). Metal cleaners.

Ransome Concrete Machinery Co. (B-102). Welding positioners.

John C. Garand, inventor of the Garand semi-automatic rifle will receive a special award. The rifle is used by the U. S. Army and Marines

Oscar E. Harder will receive the President's Medal. He is assistant director of the Battelle Memorial Institute and a trustee of the A.S.M.

John Chipman, Professor of Metallurgy at the Massachusetts Institute of Technology, will deliver the annual Campbell Memorial Lecture

Benjamin F. Shephard, Ingersoll-Rand, will receive the Albert Sauveur Achievement Award for his work in developing tool steel fracture tests

Reeves-Pulley Co. (A-419). Variable speed transmission, motor pulleys and motodrives.

Revere Copper & Brass Co. (B-306). Copper, brass and bronze products.

Riehle Testing Machine Div., American Machine and Metals, Inc. (A-418). Testing machines.

Rolock, Inc. (S-132). Wire-mesh baskets.

Rosedale Foundry & Machine Co. (B-320). Castings.

Ross-Meehan Foundries (B-320). Castings.

Rustless Iron & Steel Corp. (C-102). Stainless iron and steel products.

Safety Socket Screw Corp. (C-226). Bolts, socket set screws, cap screws, shoulder screws, keys, wrenches and studs.

George Scherr Co. (E-110). Gages, optical instruments and testing machines.

A. Schrader's Son (D-410). Valves, gages and brass fittings.

Sciaky Bros. (A-518). Seam, spot and buggy-mounted radial portable welds.

Selas Co. (D-102). Gas burners, furnaces, controllers and automatic flame-hardening equipment.

Sentry Co. (B-411). Heat-treating furnaces.

S-M-S Corp. (A-500). Welding electrodes and special alloys.

Sparkler Mfg. Co. (A-523). Filters.

Spencer Turbine Co. (E-141). Turbo-compressors and vacuum cleaners.

Sperry Products, Inc. (A-306). Flaw detectors.

Standard Oil Co. (D-336). Industrial lubricants and cutting oils.

Standard X-Ray Machine Co. (A-429). Industrial X-ray equipment.

Stearns-Rogers Mfg. Co. (B-320). Magnetic separators.

Sterling Alloys, Inc. (B-115).

D. A. Stuart Oil Co., Ltd. (C-310). Industrial oils and greases, cutting and grinding compounds.

Surface Combustion Corp. Heat-treating furnaces, burners and accessories.

Swift Electric Welder Co. (A-500). Butt, spot and projection welders.

C. J. Tagliabue Mfg. Co. (S-126). Industrial instruments and thermometers.

Taylor-Hall Welding Corp. (A-500). Pyrometers, thermometers, controllers and other instruments.

Taylor-Winfield Corp. (A-500). Electric butt, spot and seam welders.

Tel Autograph Corp. (C-233). Message and data transmitting systems.

Tempil Corp. (B-138). Hardening and tempering pellets.

G. H. Tennant Co. (S-110). Floor scrubbing and polishing machines.

Thomson-Gibb Electric Welding Co. (A-500). Spot, sheet, flash and projection welders.

Tide Water Associated Oil Co. (D-324). Sulphurized and soluble cutting oils, industrial lubricating oils and greases.

Tinnerman Products, Inc. (D-414). Fastening devices.

Titanium Alloy Manufacturing Co. (A-336). Titanium, ferro-alloys and refractories.

Harold E. Trent Co. (A-405). Salt baths and airdraw furnaces.

Triplex Machine Tool Corp. (D-310). Automatic screw machines, gear hobbing machines and lapping machines.

Ultra Lap Machine Co. (D-310). Lapping machines for flat surfaces.

Upton Electric Furnace Div. (B-424). See Commerce Pattern Foundry & Machine Co.

Valley Iron Works (B-320). Grey iron and Meehanite castings.

Vanadium Corp. of America (A-510).

Vascoloy-Ramet Corp. (A-504). Carbide blanks, tools and dies.

Victor Saw Works, Inc. (A-328). Hacksaws.

Vulcan Foundry Co. (B-320). Hoists, engines and castings.

Wall-Colmonoy Corp. (B-339). Hard-facing alloys.

Warren Foundry & Pipe Corp. (B-320).

Welding Machines Mfg. Co. (A-500). Resistance welders.

Welding Sales & Engineering Co. (A-500). Automatic welding equipment.

S. K. Wellman Co. (E-142).

Wells Manufacturing Corp. (B-310). Metal-cutting machines.

Westinghouse Electric & Mfg. Co. (B-405). Electric welders, controlled atmosphere ratings, electric contactors, alloys.

Wilson Mechanical Instrument Co. (C-137). Hardness testers.

How to Use Hardness Tests

BY T. H. GRAY, WESTINGHOUSE RESEARCH LABORATORIES

Hardness test values can give the trained observer much data on the physical properties and heat-treatment of some steels

UTILITY OF HARDNESS as a metallurgical guide arises from its relationship to other physical properties of metals which, in turn, all depend on the internal structure of the metals. Through hardness tests a knowledge of these relationships can be obtained and the efficiency of heat-treatments can be measured. Hardness itself is a physical property, but one that is as yet imperfectly understood and defined. However, for practical purposes the accepted definition of hardness as resistance to permanent deformation provides a means of measuring this property. Upon this definition most hardness testers such as the Brinell, Rockwell, Vickers and Monotron are built and used.

In heat-treating, the most satisfactory steel is usually obtained by a combination of heat-treating temperature and quenching medium which produces maximum hardness "as quenched." Subsequent tempering is used if a change in some other physical property is desired at the expense of hardness. High-speed steels, however, are exceptions to the rule that maximum hardness is obtained in the "as quenched" condition and that other desirable physical properties are obtained at the expense of hardness. With all steels the hardness after quenching is a criterion of proper heat-treatment. If this hardness fails to come up to a value characteristic of the steel, Fig. 1, hardness tests and heat-treatments must be used to determine the cause.

Characteristics of steels, such as hardness, depend largely on carbon content so much so that maximum hardness is a reproducible function of carbon content and enables the hardness test, with proper precautions, to be used for evaluating the carbon content of steels. With steels having carbon contents ranging from 0.1 to 0.6 percent, the relation is almost linear. Above 0.6 percent, the curve becomes hyperbolic, peak hardness being reached at approximately 1.1 percent. Fig. 1 shows that for carbon content above 0.8 percent the curve levels off and decreases the sensitivity of the hardness test to changes in carbon content; but with special heat-treatments, the hardness test can be used for evaluating carbon contents of more than 0.8 percent.

Decarburization is the first cause of low hardness to be suspected when steels fail to meet specified hardnesses. It is the loss of carbon from the surface of steel into the atmosphere surrounding it when the steels are heated

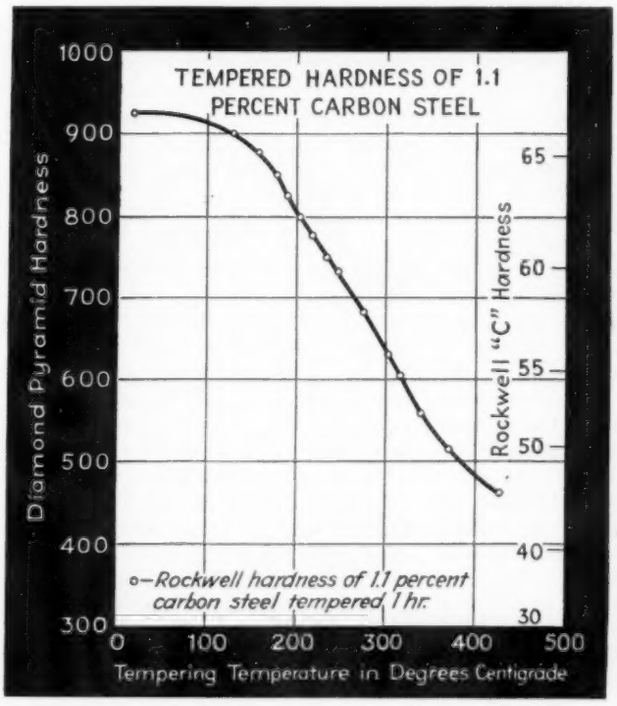


Fig. 1—Hardness after quenching is a criterion of proper heat-treatment of any steel. If hardness fails to come up to a value characteristic of a given steel, hardness tests may be used to determine the cause

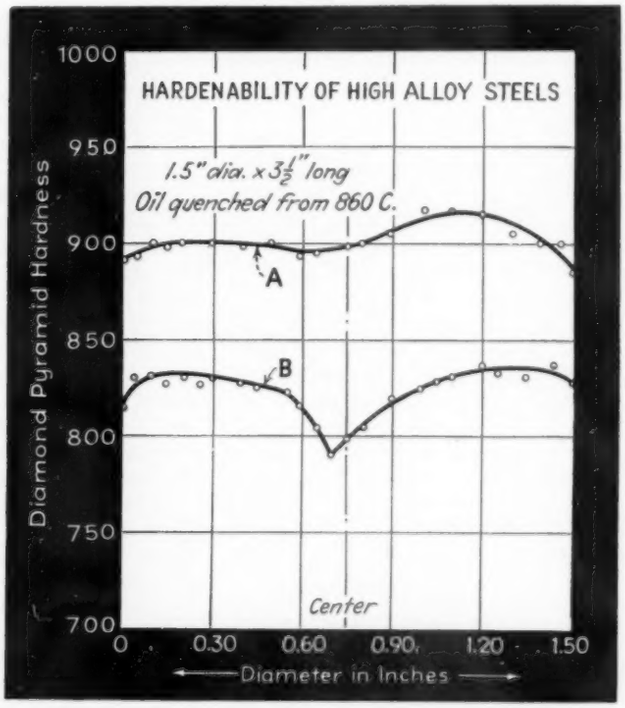


Fig. 2—The effect of high hardening temperatures on high-carbon steels is the production of a structure known as "retained austenite." Presencce of austenite can be detected by cooling in dry ice

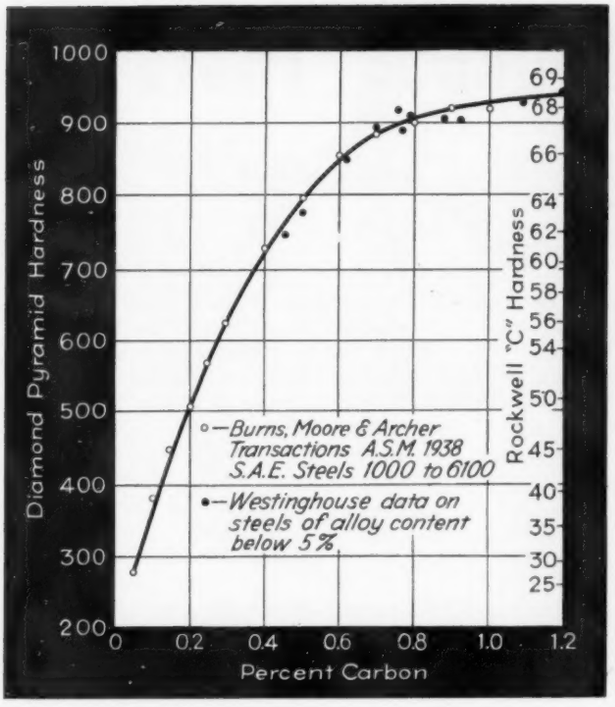


Fig. 3—The hardness test is important as a means of tempering control. Curves of hardness versus temperature are available for all commercial steels. Tempered hardness is a function of the composition of the steel

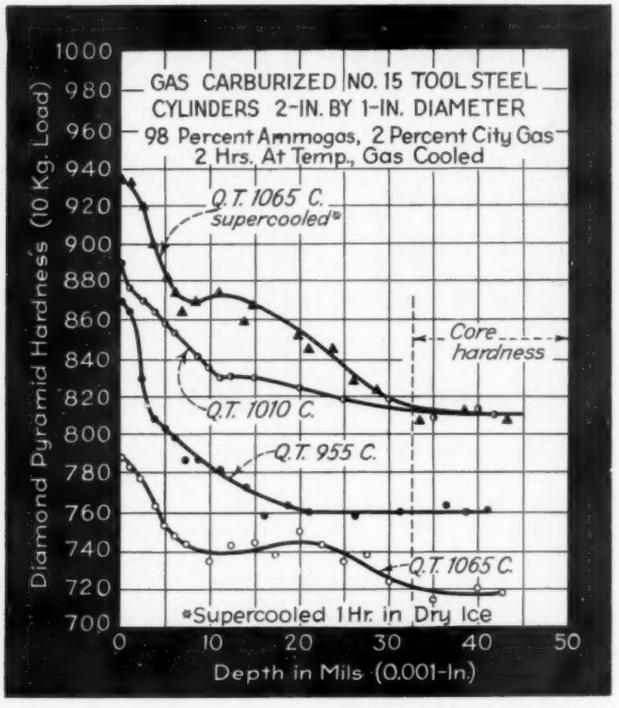


Fig. 4—The most extensive method of studying hardenability is carried out by sectioning the test specimens and making hardness tests across the diameters. Curves for two deep hardening alloy steels, *A* and *B*, are shown

for forging, annealing, or hardening. Decarburization of a finished steel part may be introduced in two possible ways. The first way is in steel stock itself, which may have a deep decarburized layer from which insufficient metal is machined to remove all of the decarburized surface. The second way is during the heat-treatment of the machined steel for hardening. Prevention of decarburization is important as it results in the loss of wear resistance at the point where it is most needed, at the surface. It lowers the endurance limit of SAE steels, causing service failures, and it increases the expense of producing tools and dies, for it necessitates expensive grinding with its dangers of cracks, checks, and tempering.

Detection of Decarburization

The hardness test can be used in two ways to determine decarburization. Both methods depend on penetrating the surface of the steel to different levels so that the differential effects of a soft decarburized skin will be brought out by the hardness test.

1. *Differential Loading*—Penetration into different hardness zones can be obtained by varying the load on the hardness tester. This naturally assumes using a hardness test such as the diamond pyramid test which yields hardness values unaffected by testing load. The Rockwell superficial hardness tester using 15 and 30 kg. loads on a cone-shaped indentor can also be used. However, with this tester the conversion relationship between the 15-*N* and 30-*N* scales is required to determine the change in hardness. The differential loading method is a quick and easy method of detecting decarburization, but it suffers the disadvantage of not revealing the depth of decarburization. It is not particularly sensitive.

2. *Differential Depth Sectioning*—This method is preferred because the depth of decarburization and the hardness at the different depths can be determined. A bevel with a slope of 10 to 1 or 20 to 1, depending on the sensitivity desired, is ground into the steel specimen, exposing the various graduations of hardness from that of the surface to that of the core. Grinding must be done cautiously in order to not temper the steel. Along the slope at measured intervals hardness tests can be made with either the Rockwell superficial tester or with the diamond pyramid test. This method is not sensitive with the Brinell test nor, at times, with the Rockwell "C" tests, because of the thinness of the decarburized zones and the comparatively deep penetration of the Brinell and the Rockwell "C" tests, shown in the accompanying table.

In this study of the failure of steel to respond to heat-treatment, all that is required for the detection of decarburization is to grind a small depression in the steel surface and take hardness readings at the bottom of the depression as well as on the surface. If the hardness values are identical, the cause is not decarburization but something else, but if the surface hardness is much lower, decarburization is at fault.

Effects of Excessive Heat

If decarburization is not at fault, the next possible cause of low hardness is the use of excessive hardening temperatures. The effect of high hardening temperatures on high-carbon steels is the production of a structure of steel called retained austenite which lowers the hardness. This is shown in Fig. 2, where the core hardness of the steel quenched from 1065 C. is much lower than the core hardness of the steel quenched from 955 or 1010 C. This drop in hardness depends on the amount of retained austenite, the greater the amount of austenite the lower the hardness. The presence of austenite can be easily detected by cooling the steel in dry ice for a period of ½ to 1 hour and then retesting its hardness. If the hardness has increased by several points Rockwell "C" or 50 points

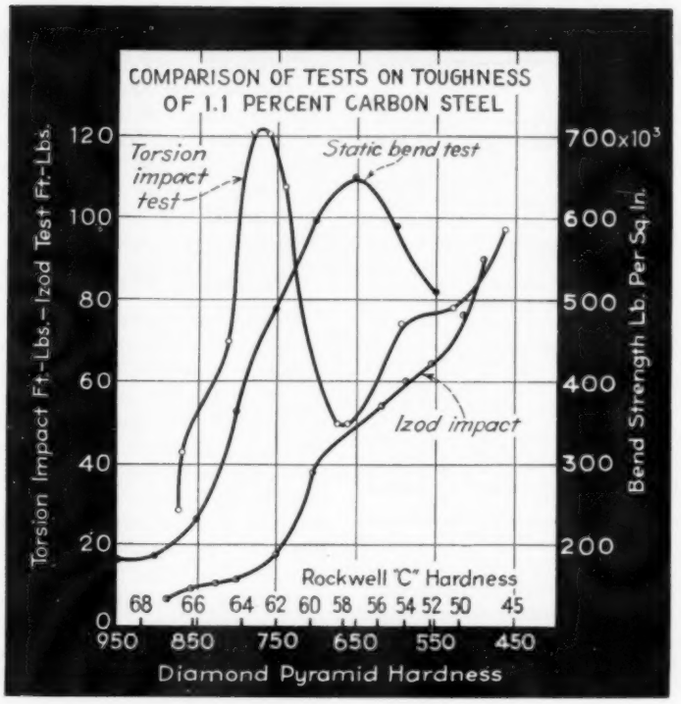


Fig. 5—Caution must be used in attempting to judge toughness from hardness measurements. The relationship of hardness to toughness is not as simple as it is with tensile strength and depends on the composition of the steel

diamond pyramid hardness (DPH), the steel has been overheated. The increase in hardness is a result of the transformation of the residual austenite to martensite at the low temperature of dry ice. This increase in hardness is shown in Fig. 2 by the increase of 100 points DPH in core hardness of the steel hardened at 1065 C., after it was supercooled in ice for one hour.

Temperatures Too Low

A third cause for low hardness may be hardening temperatures that are too low. If the steel does not respond to the dry-ice treatment, the low hardness may be caused by inadequate solution of carbides at low hardening temperatures. To investigate this possibility, the steel is rehardened at temperatures from 25 to 50 C. higher than that used previously, and the hardness is rechecked. Incomplete soaking (insufficient time at hardening temperature), will act similarly to insufficient temperature in producing low hardness. If higher hardening temperatures or longer soaking times do not produce an increase in hardness, further investigation will be required.

The piece may be so large that the steel cannot be cooled fast enough to exceed its critical cooling rate. The effect of mass on hardening properties of a given steel can be studied by heat-treating a small and a large mass of it together and testing their hardness, or by requenching a small piece of the steel and measuring its hardness. If the size effect is pronounced, the steel of this particular composition cannot be used, and a steel having a slower cooling rate will have to be substituted in its place.

Quenching Mediums

The fifth cause of low hardness may be in the failure of the quenching bath to cool the steel at a rate fast enough to exceed its critical cooling rate. To harden steel, the structure must be transformed to austenite at the hardening temperature and then cooled at a rate faster than its critical cooling rate by the quenching media. If the fault is in the quenching medium, hardness tests should be tried on the steel cooled with a faster quenching medium.

The final cause will be the use of steels having the wrong analysis if all previous tests show negative results. After checking for decarburization, a spark test should be made on the steel for a rough determination of its type. If this reveals nothing and all the preceding tests fail to explain the low hardness, an exact chemical analysis of the steel should be made.

So far in this discussion the hardness test has been mentioned in connection with the hardening portion of the heat-treating procedure, but the hardness test is just as important as a means of tempering control. Steels in their "as quenched" state are normally too brittle to be used for applications where high stresses are encountered. This means that they must be softened or tempered by heating the hardened steel to some temperature below the critical range. The amount of tempering, controlled by the physical property desired, is measused by the hardness of the steel. Hardness decreases with an increase in tempering temperatures for most steels except in the high alloyed steels where the phenomena called secondary hardening is encountered. As the tempered hardness is a function of its composition, curves of hardness versus temperature are necessary and available for all commercial steels. Fig. 3 is a typical tempering curve for carbon tool steel.

Measuring Case Depth

Hardness tests are especially important in the case-hardening of steels. Both methods used in the detection of decarburization can also be used for the determination of case depth, but the method of differential sectioning provides the most information concerning the hardness and penetration of the case. Grinding a slope may not be practical for shop tests, but a rough test can be made by grinding a $\frac{1}{32}$- or $\frac{1}{16}$-in. depression and testing the original surface and the bottom of the depression with the Rockwell or diamond pyramid test. A typical example of case-hardening study by the use of the hardness test is shown in Fig. 2. Variation in hardness throughout the case is shown as well as the depth of case.

One of the important characteristics of steels is their "hardenability," or ability to harden through a thick section. Hardenability is largely dependent on composition; chromium, molybdenum, manganese and other elements will add to the hardenability of carbon steel. Since the effect of hardenability on the other physical properties is great, the subject is of much importance to the metallurgist who has studied it mainly through the use of hardness tests.

Sectioned Specimens

The most extensive method of performing hardness tests in hardenability studies is by sectioning the test specimens and making hardness tests across the diameters of the exposed surfaces. An illustration of such a hardenability test is shown in Fig. 4

DEPTH OF PENETRATION OF HARDNESS TESTS

Hardness of Stock		Depth in Inches						
		DPH		Rockwell Brale		Rockwell Superficial		B H N
DPH	Rc	10 Kg.	50 Kg.	Rc 150 Kg.	Ra 60 Kg.	15 — N 15 Kg.	45 — N 45 Kg.	10 mm Ball 3000 Kg.
1000	70	0.00076	0.0017	0.0025	0.0013	0.0003	0.0011	.....
900	67.4	0.00081	0.0018	0.0027	0.0014	0.0003	0.0012	.....
800	64.2	0.00086	0.0019	0.0030	0.0015	0.0004	0.0014	.....
700	59.7	0.00092	0.0020	0.0033	0.0017	0.0005	0.0016	0.0060
600	54.7	0.00100	0.0022	0.0038	0.0020	0.0006	0.0019	0.0071
500	48.5	0.00110	0.0024	0.0044	0.0023	0.0007	0.0022	0.0085
400	40.8	0.00120	0.0027	0.0050	0.0027	0.0009	0.0026	0.0102
300	30	0.00140	0.0031	0.0059	0.0033	0.0012	0.0032	0.0134
200	15	0.00170	0.0038	0.0072	0.0041	0.0015	0.0040	0.0197

on two deep hardening alloy steels, one having slightly better hardening characteristics than the other. The hardenability is shown by comparing the drop in center hardness to the surface of the particular steel, not by the lower general hardness of one steel to the other.

Other Properties Shown

The relationship between hardness and tensile strength has been well established and is in extensive use. Tensile strength varies linearly with hardness for steels of almost all compositions and can be closely expressed by the empirical equation: Tensile strength in lb. per sq.in. $= 480 \times$ DPH, over the range 100 to 660 DPH. The DPH refers to the diamond pyramid hardness, which can be obtained through tables of conversion relations from Rockwell "C" or Brinell hardness tests. (See "Hardness Conversion Relationships for Hardened Steels," by H. Scott and T. H. Gray, ASM *Transactions*, 1940.)

As a general rule the harder a steel is, the greater wear resistance it has to abrasion, rubbing and other frictional wear. Therefore, to obtain more wear resistance, steels are made as hard as possible. Often a compromise must be made, however, to obtain increased toughness at the expense of hardness. Caution should be applied in applying the rule of the hardness-wear resistance relation as it applies only to steels of the same general class. Comparisons of steels of different grades are complicated by the effect of alloying elements on increasing their wear resistance. For example, a high-chromium die steel may have a hardness below that of a chromium steel of the same composition, however, the harder steel usually has the greater wear resistance.

Machinability and ductility of steels both vary with hardness; the lower the hardness, the more ductile the steel becomes and the more machinable on rough turning. Limits of machinability are reached at hardness from 320 to 400 DPH, depending on the tools used. Of course when elements such as sulphur are added to steel to confer free machining characteristics, this rough relation of machinability to hardness falls down.

The attempt to link hardness to toughness had led to much confusion as both properties are imperfectly understood. However, toughness has been understood to be a combination of strength and ductility, and this serves as a workable definition for the evaluation of toughness. The relationship of hardness to toughness is not as simple and straightforward as it is with tensile strength, but is a relationship that varies with the composition of the metal.

Tempered Steels Toughest

Because of the effect of steel composition on its toughness (more accurately the effect of internal structure as modified by composition on its toughness) no general relationship can be given. Steels in their hardened, "as quenched" state are brittle presumably because of high residual stresses. In the annealed state, steel has low toughness because of lack of strength. In the intermediate hardness range (the range of tempered steels) the best combinations of strength and ductility are achieved to produce high toughness. For tool steels this toughness range is from 560 to 660 DPH (50 to 57.5 Rockwell "C"). This range is not fixed, however, and depends on whether impact tests, torsion-impact tests, or static-bend tests are used as a measure of toughness. A comparison of the results of the three types of tests, Fig. 5, shows that caution must be used in attempting to judge toughness from hardness measurements.

Concentration of Industry In Great Britain

England has initiated a new policy concerning production of goods for civilian consumption. Production facilities are to be concentrated on the manufacture of standardized "utility" articles. Such products are defined as "goods sufficiently clearly designed for their prices to be fixed, planned to meet essential needs in a sensible manner and produced in the most economical way possible."

To attain this, controls have been put on the total amount of raw materials to be used and on the total amount of civilian supplies. Factories producing civilian goods have been drastically cut in number. Standard fixed price goods are produced in a quantity calculated exactly to meet essential civilian needs. The Concentration Plan was designed to rationalize future production so as to save part-time working and to release labor and factory space in areas where they would be useful to the war production program.

Accordingly, in every industry covered by Limitation of Supplies Orders or by controls over raw materials, plants not working at full pace, or needed by the war program, cease operation and transfer their quota of production to "nucleus" firms. In 14 months, 250,000 workers and 55,000 sq. ft. of factory space have been released through concentration.

The problem of brand names was met in various ways. Where they could not be maintained, they were sometimes replaced by a wartime substitute brand, representing a joint production of different firms. In some cases, nucleus firms produced goods under trade names of closed plants.

Concentration has extended to cover distribution of food, the Civil Service, banks and financial institutions and has been discussed for the entire retail trade.

New Uses of Induction Heating

BY RUPERT LEGRAND, DETROIT EDITOR, AMERICAN MACHINIST

Melting, heat-treating, forging and brazing are among the many uses to which induced currents have been applied to war work

INDUCTION HEATING has come of age under the stimulus of wartime requirements. The first practical application of high-frequency current to heating was made in 1916. Commercial development was largely keyed to melting purposes until 1928, when successful application of the process to hardening automotive camshafts and crankshafts selectively attracted the attention of the metal-working industry.

Currently, induction heating is filling many war needs: melting alloy steel for the centrifugal casting of superior gun barrels; heating bar stock for forging shell; heating steel shell cases for heading and tapering; annealing gun parts selectively; hardening armor-piercing shot, gears and shafts selectively; brazing bomb bodies and aircraft subassemblies.

Process Has Advantages

The fact that electrically induced heat can be applied just where it is wanted and to exact depth and temperature opens new fields to the designer and production man. Parts can be redesigned to reduce weight, to use less critical materials and to simplify production processes. Induction heating equipment can be located directly in the production line, because it takes little space and throws off little heat. A number of units can be installed to keep pace with the preceding and following machines in the line.

More convenient, or simplified, machining practice is frequently a by-product of the induction heating process. For hardened work, the short heating cycle involved (usually only a few seconds) minimizes distortion and oxidation, saves operations. But in wartime, two much more important factors may be realized: (1) the saving of critical alloys by the substitution of carbon steels for alloy steels, and (2) important tonnage savings by reason of the fact that induction hardening a part giving trouble will avoid putting more material into it, or even permit lightening the part.

Machines Are Versatile

Since induction heating is an electrical operation, successful application depends in some measure upon an understanding of the phenomena of high-frequency circuits. Most induction heating machines are not single-purpose and can readily be adapted to new jobs, a point to be considered in relation to post-war production.

Effectiveness of heating by induction depends upon: (1) frequency of the current supply, (2) the resistivity, permeability and condition of the work, and (3) the electrical coupling between the inductor and the work. Most prewar experience was built up in the fields of selectively hardening and annealing steels and pearlitic malleable irons. But non-magnetic materials can be heated effectively in a high-frequency field under proper control; hence the process has spread into such operations as mouth annealing brass cartridge cases and selectively annealing aluminum aircraft subassemblies.

Heat From Magnetic Field

Induction heating is made possible by the fact that electrical energy can be transferred to a workpiece from a magnetic field surrounding an inductor charged with high-frequency current. In effect, the inductor block is the primary of a transformer, and the workpiece is a secondary consisting of one coil short-circuited upon itself. Heating is achieved through the phenomena of hysteresis, eddy currents and skin effect.

Differential heating—the basis of selective heat-treating—is made possible by the tendency of induced alternating currents to crowd at the surface of the work (the phenomena of skin effect). The density of alternating current flowing in a conductor decreases logarithmically from the surface. Skin effect becomes more pronounced with increase in frequency. Thus, the induced currents are constrained to a shallow depth, resistance to current flow is increased, and the rate of heating rises. There is a different depth of current penetration for each material and each frequency. See Table I.

Resistance of the material also affects the rate at which energy is absorbed. The depth of penetration of induced currents in copper, for example, is less than in graphite, but the higher resistivity of graphite enables it to absorb larger amounts of energy, whereas the low resistivity of copper makes its heating by induction more difficult.

Effect of Temperature

With most materials the rise in temperature causes increased depth of heating. Surface layers of steel, for example, become non-magnetic at red heat causing the metal to take on radically different characteristics. Penetration depth varies directly as the square root of the resistivity of the charge and inversely as the permeability of the charge and the frequency applied. It is evident, therefore, that if steel with a permeability over 1,000 passes through the critical stage, the depth of the heating currents is much greater. Additional heat penetration results if the period is sufficient to permit conduction.

In addition to temperature and depth of heat penetration, as affected by

Table I—EFFECT OF FREQUENCY UPON DEPTH OF INDUCTIVE HEATING IN INCHES FOR EXTERNAL WORK

Material	Frequency, cycles per second 1000	10,000	100,000
Copper	0.100	0.031	0.009
Cast Iron	0.045	0.014	0.005
Graphite	2.5	0.780	0.250
Rail Steel	0.011	0.004	0.001
Stainless Steel	0.620	0.190	0.062

characteristics of the material, the size and contour of the workpiece have a bearing upon selection of current-supply frequency. Experience has dictated the development of 1,000-, 2,000-, 3,000- and 10,000- or 12,000-cycle motor-generator sets, which are capable of handling the bulk of external induction heating applications. These machines are self-contained, and the automatic heating cycle can be reset as desired for a wide range of operations with a unit of given rating. Power-tube equipment for frequencies up to several million cycles are on the market for the more special-purpose uses.

For external cylindrical work, the 2,000- and 3,000-cycle sets are found efficient for hardening work down to 1 in. in diameter although ½-in. rounds can be hardened with some sacrifice of efficiency. The 10,000-cycle equipment has a broader work-diameter range for hardening purposes—down to ½ in. with high efficiency and to ¼ in. if necessary. Power-tube equipment is becoming less expensive by intensive development work, but for the present may be considered limited to the more special applications.

Theoretically there is no maximum upper limit for external diameter that can be induction heated. The amount of labor is usually the governing circumstance, not the cost of power. A tractor drive gear 28 in. in diameter by 5 in. face width, is being successfully hardened with a 300-kw., 10,000-cycle set at a cost less than by other methods.

The shape of the work influences the choice of frequency. Fine-pitch gears can be hardened on the tips and meshing surfaces with 2,000- or 3,000-cycle current. For coarse-pitch gear teeth and splines, where the magnetic flux of the field has greater difficulty in following the contour, the 10,000-cycle equipment gives better results. Experimental studies have disclosed that frequencies in the order of 100,000 cycles or more are required to achieve the effect of a continuous carburized case of uniform depth on tip, flanks and root of coarse-pitch gear teeth and the splines of transmission shafts.

Interruptions in work surfaces, such as oil holes in crankshafts, require special consideration. There is a tendency for the edges of such holes to overheat with 10,000-cycle current (which would be most satisfactory for the journals) and hence the hardening of crankshafts is carried out on 2,000- or 3,000-cycle equipment.

For a fixed frequency and a given work cross-section, a low power input and a long heating time give a greater depth of heat penetration than a high power input and a shorter time cycle. Any reference to dimensions and power required to achieve a specified degree of heat penetration must be considered approximate because there are a number of variables in any given problem.

TABLE II—PRODUCTION RATES FOR PROGRESSIVELY HARDENING STEEL BAR STOCK

Material	Diameter In Inches	Power Required	Depth of Hardness	Inches Per Min.
SAE 1045	1	40	1/8	22
SAE 1045	2¼	60	7/64	22
SAE 1345	⅝	46	1/8	44
SAE 3140	1¼	40	11/64	22
SAE 3140	1¼	60	7/64	30
SAE 52100	1½	70	7/64	52

This table indicates the relative induction-heating machine settings for various materials but does not show the power drawn at the switchboard.

In hardening operations, for example, the grain structure and response to heat-treatment of the material affect the actual amount of power that must be applied per square inch of surface. Experience indicates that a safe average estimate to harden 1 sq. in. of SAE 1045 steel to a depth of ⅛ in. is 40 kw. of 10,000-cycle current for one second. Thus, slightly over three seconds would be required to harden a 1-in. length of SAE 1045 bar 1-in. in diameter. But if a 2-in. bar were later substituted in a machine capable of supplying 40 kw. the time cycle would increase out of direct proportion and the depth of heating would be greater.

Progressive Heating

If the length of work to be heated is too great for one "shot," sections may be heated progressively. Production speed of progressive heating (usually annealing or hardening operations) depends upon the material, work size and whether the product is solid or hollow. Table II gives production speeds for progressively hardening several steels. If a tube with a ¼-in. wall thickness were substituted for the 1-in. SAE bar cited, the production speed would be doubled approximately. And if 18-gage tubing were heated (work requiring through hardening) the heating rate would be five to ten times as great as for the solid bar. In cases where localized heating is desired at various points on bar or tubular materials, the induction heating machine is fitted with a locating and indexing fixture.

Inductor Block Design

Most induction heating apparatus is supplied to take interchangeable inductors, or heating coils. In the case of the cabinet-type motor-generator sets for external applications, a change in operation means bolting on the proper inductor, substitution of work-holding fixtures and resetting the controls. Manufacturers of the heat-treating machines stand ready to train users in the art of making suitable inductors.

Inductor coils for external work are made usually from hollow copper tubing to permit water cooling as in Fig. 1. If non-uniform heating is desired, or certain portions of the work tend to overheat, the coils are wound in uneven pitch or spacing. Coils may be of square or irregular cross-section, and produced in helical, flat, loop or dish shapes to follow the work contour.

The flow of induced currents in the workpiece affects coil design. Eddy currents tend: (1) to follow the surface of the work, (2) to flow parallel with the inductor coil, (3) mutually to repel each other.

Transfer of energy from the inductor to the work depends upon the electrical coupling between the two—the ratio of work diameter to coil diameter and the size of gap between them. The effect of coupling is shown in Figs. 2 and 3. Although the work coils are the same in both examples, the larger mean diameter of the coil in Fig. 3 reduces the effective heating zone on the workpiece.

Eccentrically loading the workpiece in the coil has advantages and disadvantages. If a stationary part of constant cross-section is loaded eccentrically in a one-turn coil, Fig. 4, non-uniform heating results, since the induced currents on the side farthest from the inductor tend to spread apart. With multi-turn coils, as in Fig. 5, this effect is largely dissipated.

The tendency of induced currents to repel each other is used to good effect, however, where stepped-down or

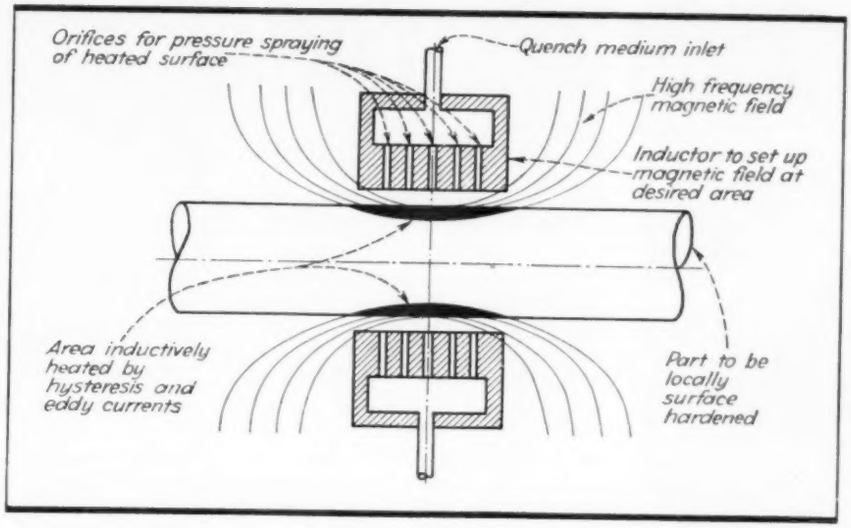
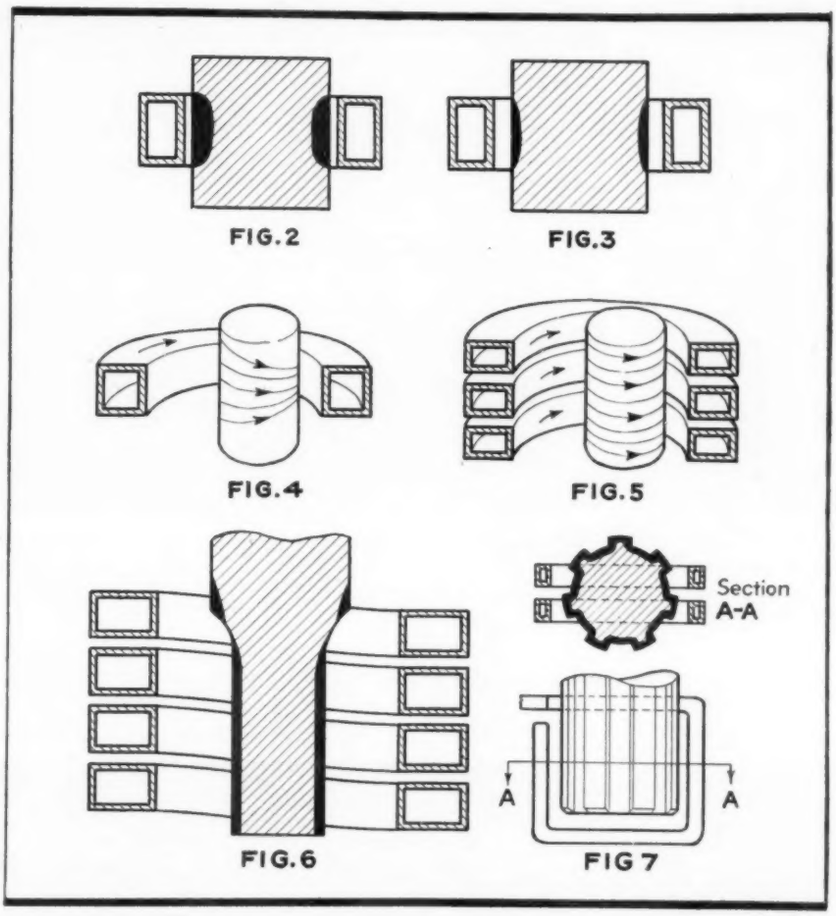

Orifices for pressure spraying of heated surface
Quench medium inlet
High frequency magnetic field
Inductor to set up magnetic field at desired area
Area inductively heated by hysteresis and eddy currents
Part to be locally surface hardened

Fig. 1—Induction heating is accomplished by the transfer of energy from a high-frequency magnetic field to a workpiece. Shown schematically are the inductor block and field created for locally hardening a bar



Inductor design is influenced by the action of induced currents. Figs. 2 and 3 —Electrical coupling affects the depth of zone heated on the workpiece. Figs. 4 and 5—Induced currents mutually repel each other if the magnetic field is weak, but a multi-turn coil overcomes this effect if the work is eccentrically loaded. Fig. 6—Changes in work cross-section disturb induced-current flow, resulting in overheating of the shoulder and underheating the radius. Fig. 7 —To attain even heating of crest and roots of spline shafts, one method is to use a loop coil and to rotate the work

necked shafts must be hardened locally. If placed centrally in the coil, the shoulder tends to overheat and the radius is underheated, Fig. 6. By placing the work off center in a rotating fixture, the entire contour can be uniformly heated.

Induced currents tend to concentrate upon work protuberances such as shoulders, tips of gear teeth, crests of threads and splines. If uniform heating is desired over the entire contour, it can be effected in two ways. First, work such as a spline shaft can be passed through a helical coil, in which case the induced currents flow at right angles to the splines and are constrained to follow the crests and roots in sequence, while traveling around the periphery of the part. Or second, a loop coil, Fig. 7, can be used. In this case the loop is parallel to the splines and the workpiece is rotated so that the periphery is progressively heated.

The area about cross holes in workpieces tends to heat unevenly by diversion of induced and eddy currents. A copper plug inserted in the hole overcomes the difficulty.

Applying the Quench

In hardening applications of induction heating, water quenching immediately follows completion of the heating cycle. Water quenches can be timed to 0.10 sec. for "one-shot" setups. Frequently the functions of cooling the inductor and quenching the heated work zone are combined in one block. Jet holes are located carefully at the proper angle (which varies with the job) to quench the work in proper relationship to speed of work travel through the inductor. Obviously this arrangement reduces scaling and distortion to a minimum.

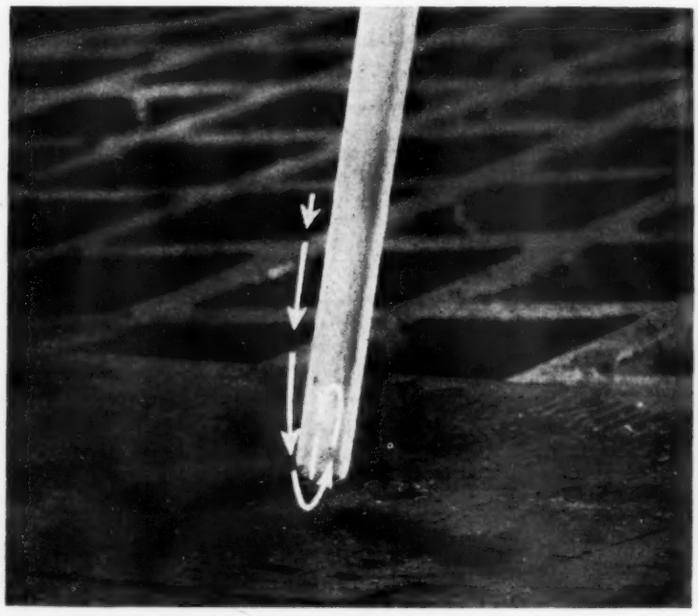
Any material, generally speaking, that will respond to a heating and quenching cycle can be surface hardened by the induction method. The original condition of the material has a bearing upon the results obtained. For any given steel, if the stock has not been heat-treated properly (normalized or annealed to obtain a fine and uniform grain structure which responds best to the short induction heating cycle) the resultant structure will not be uniform. To secure maximum hardness and uniform structure, parts designed for severe service should be given an initial heat-treatment to obtain a predominately sorbitic structure or normalized to a grain size comparable with that desired in the hardened condition.

Part 2 of this article will appear in an early number.

The Inside of Arc Welding

FOUR MAIN FACTORS determine the success of arc welding with shielded electrodes. These are the length of arc, angle of electrode, current setting and speed of travel. When each of these is properly controlled the arc will make a steady frying sound. The movement of metal towards the rear of the crater and the shape of the crater are also excellent checks on the quality of the work.

Some basic hints as to the control of these factors and the use of the electrode in various types of welds are shown in the pictures on these pages, which are taken from the General Electric film "The Inside of Arc Welding." In a correctly made deposit the ripples are uniform and build up a smooth bead which joins the plate with no overlap or undercut and has complete fusion.

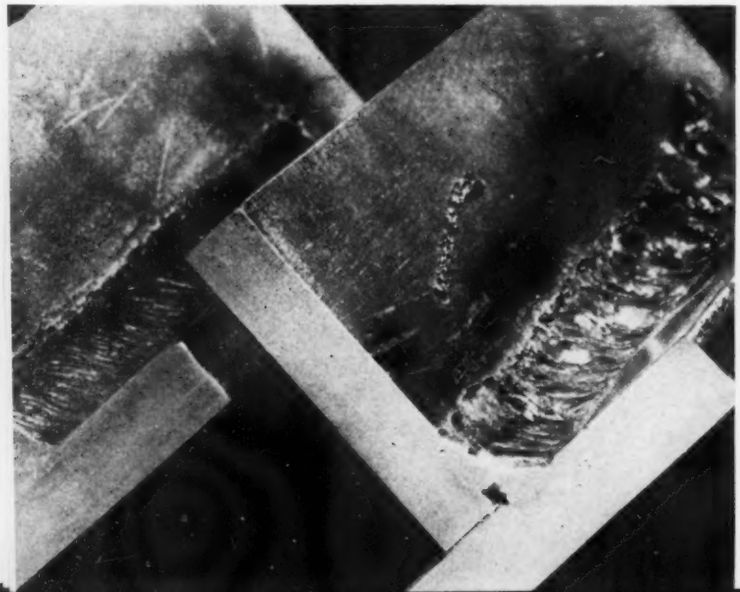


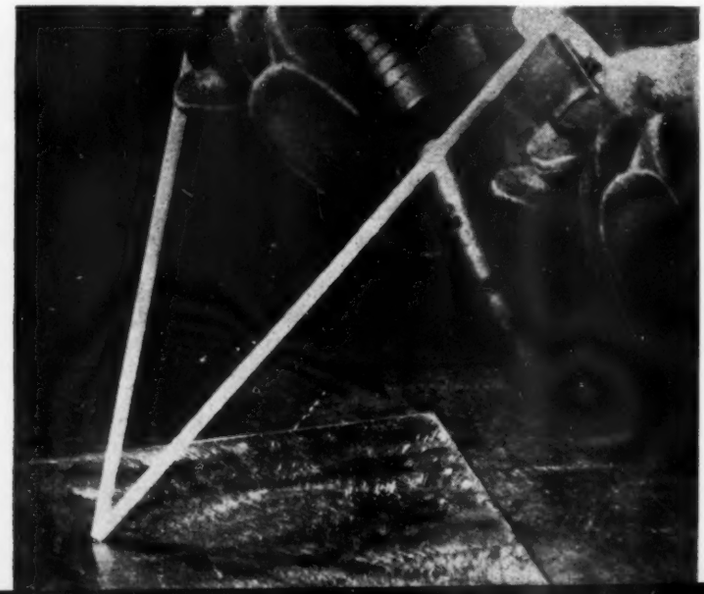
Before beginning to weld, the operator should always be sure he has proper protective clothing. Never look at the arc without full protection for the eyes.

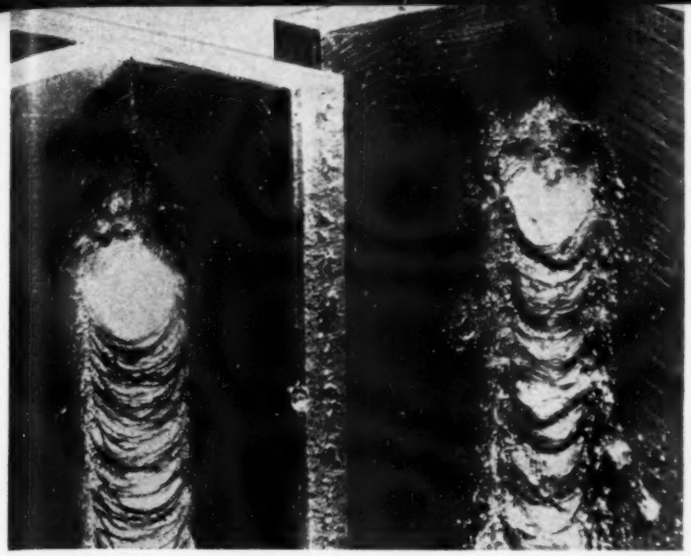
The simplest method of striking an arc is a scratching motion; more experienced operators touch the plate, bring electrode up to a long arc then down to working length.

Too short an arc, at the right, resulted in gas and slag inclusions; electrode may freeze to the work. Too long an arc will melt off the electrode in globules causing spatter.

Proper angle of electrode is shown at the left. Too low an angle, as at the right, produces a distorted bead; if tilted to one side a lopsided or crooked bead results.

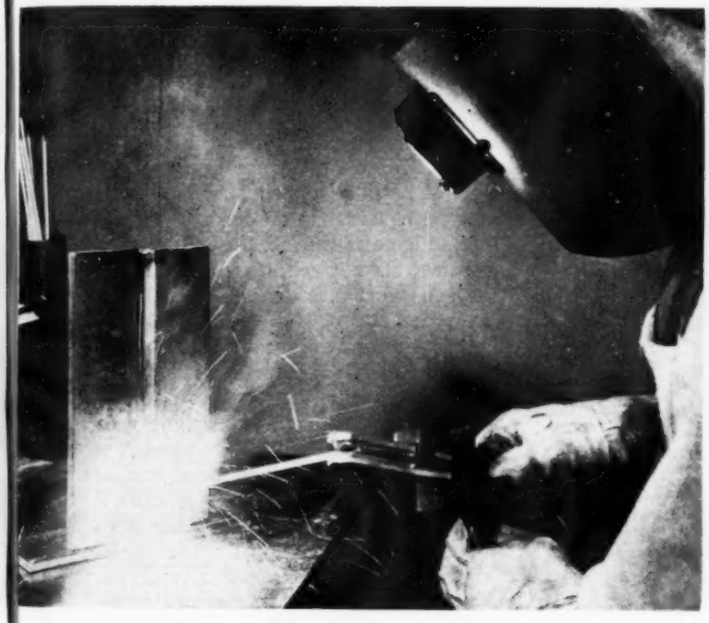






Proper current was used at the left. Too high current at the right caused a wide bead, spatter and too much penetration. Too little current won't melt the base metal properly.

Proper speed of travel forms an oval crater. If travel is too fast, the metal does not stay molten long enough and traps gases; if too slow the molten metal piles up.



In vertical welds, the operator builds a shelf of weld metal to support the molten metal. Heat is removed between cycles to allow the metal to solidify partially.

In the overhead position, gravity limits the size of the molten pool. To offset this effect, the electrode is directed more toward the overhead plate.

In making long welds, where more than one electrode must be used, it is necessary thoroughly to remove the slag from the crater. It is chipped off as shown.

In multiple-layer fillet welds, the first layer must be cleaned before the second pass is started. Good fusion is made between the base metal and each of the passes.

Finishing Sprayed Metals

BY W. C. REID, VICE-PRESIDENT, METALLIZING ENGINEERING COMPANY

Definite precautions have to be taken when machining, grinding and polishing metallized parts

THE STRUCTURE of sprayed-metal deposits is granular rather than homogeneous and resembles layer upon layer of minute shingles. This creates problems in finishing not encountered when machining and grinding rolled or cast metals.

There are other factors not in any way connected with machining or grinding which can and do have a pronounced effect on the ultimate finished surface of sprayed metal. These factors are as follows:

1. The analysis, temper, diameter and physical properties of wires to be sprayed have definite effects on the quality of the finish. Wires for metal spraying have been developed over a period of years, just as have rods for welding, and they produce definite surface characteristics after spraying.

2. The texture or density of the coating, due to the degree of atomization of the spray, has a definite effect on machining and grinding—the finer the atomization, the better the machine or ground surface. Poor atomization may be due to low air pressure, wrong balance of gas-pressures, fluctuation of the wire speed, or to the condition of the wire nozzle or air gap of the gun. If, for any of these reasons, the gun throws large particles of metal on the work, the surface when finish machined or ground is apt to be spotted or pitted.

3. Incorrect spraying speeds will give deposits which will not finish properly. Low traverse speeds during spraying will cause laminated coatings, resulting in layer separation.

4. High work temperatures will cause warping of the parts or cracking of the sprayed metal. In this case, the work should be stopped until it is cool enough to touch without discomfort. Clean dry air may be directed against the piece opposite the spray gun to reduce the work temperature. When this is done, the air blast should always be shut off before stopping the rotation of the work.

5. Cleanliness of the air supply affects the finish. Small quantities of moisture do little harm, but large quantities must be avoided. Oil in the air supply may be deposited on the work around the sides of the stream of metal particles, resulting in a slightly oily surface which retains the dust and oxides normally blown away by the blast from the gun. Consequently, under this condition, each time the gun traverses the work, a distinct layer of dust and oxide will be formed that is detrimental to the deposited metal.

6. The distance between the gun and the surface being sprayed should be 5 to 8 in.

7. The angle at which the sprayed metal strikes the surface of the work should be 90 deg. whenever possible, and never less than 45 deg.

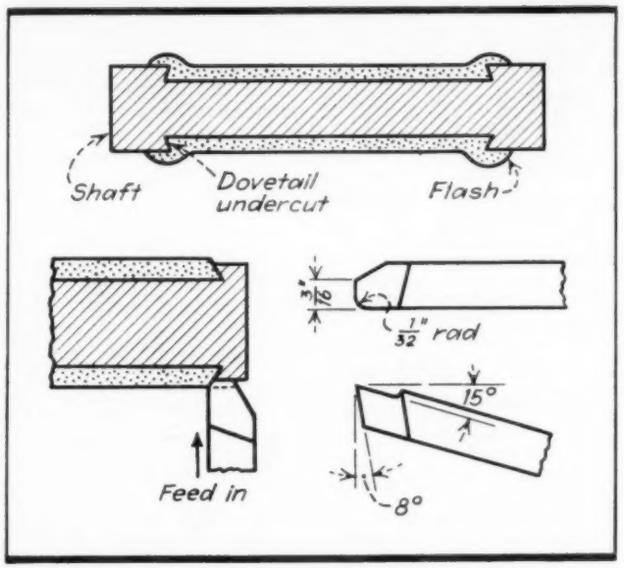
8. Flame setting of the gun should be neutral, not oxidizing (too much oxygen) or carburizing (too much acetylene).

Machining or grinding troubles should call for an investigation of the foregoing eight items before and not after an investigation of machining or grinding procedures.

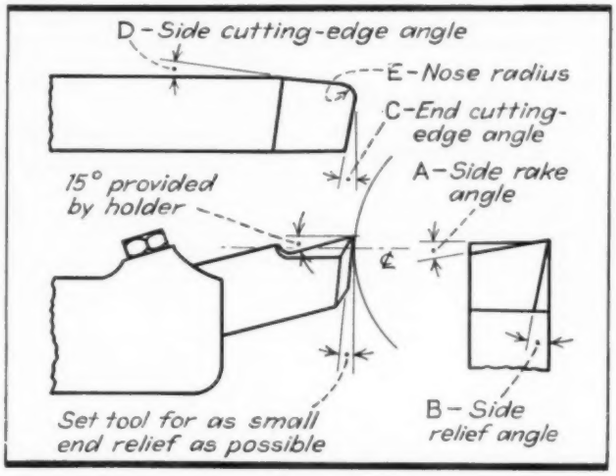
The procedures and recommendations herein given for finishing sprayed metals are based on tests made with wire prepared specifically for metal spraying. Other wires, even if of the same chemical analyses, may not necessarily give the same surface characteristics after spraying.

Because of the structure of sprayed metal, cutting tools have a tendency to tear, rather than cut or shear it. A little experimentation in tool setting and tool grinding may be necessary before this condition can be eliminated. A general rule is to set the tool sufficiently above center to reduce the end relief angle to a minimum, especially for finishing cuts. The usual procedure is to machine within 0.010 to 0.015 in. of the finished dimension on the first cut, taking the balance on the finishing cut and allowing for filing or polishing with emery cloth.

The particular structure of sprayed metals, as well as oxide and carbon inclusions, subject the nose of a cutting tool to much abrasion and wear. This makes it difficult to maintain accurate dimensions when using ordinary high-speed steel tools, especially on large



Sprayed carbon steels sometimes form a hard ring adjacent to the ends of the undercut section. These hard rings should be turned first with a flat-nosed tool, which should be fed into the raised section of the coating, rather than laterally against the flash


D – Side cutting-edge angle
E – Nose radius
C – End cutting-edge angle
A – Side rake angle
15° provided by holder
Set tool for as small end relief as possible
B – Side relief angle

HIGH-SPEED TOOLS, SPEEDS AND FEEDS FOR MACHINING SPRAYED METALS

Tool No.	Angles, deg. A	B	C	D	Nose rad., in. E
1	0	10	10	3–5	0.030
2	10	10	10	3–5	0.030
3	15	10	10	3–5	0.040

Metal	Tool No.	Surface speed, ft. per min.	Feed, in. per rev.
Aluminum ***	3	150–200	0.003–0.005
Sprababbitt	3	150–250	0.005–0.007
Sprabrass Y *	2	100–125	0.003–0.005
Sprabronze A	1	100–125	0.003–0.005
Sprabronze C *	3	100–125	0.003–0.005
Sprabronze M	1	100–125	0.003–0.005
Sprabronze P	1	100–125	0.003–0.005
Sprabronze T	1	100–125	0.003–0.005
Monel	3	100–125	0.003–0.005
Nickel	3	100–125	0.003–0.005
Sprairon A **	3	75–100	0.003–0.005
Copper ***	3	100–125	0.003–0.005
Lead	3	150–250	0.005–0.010
Metcoloy No. 1	3	100–125	0.003–0.005
Metcoloy No. 2	.. Grind	.....	.....
Sprasteel 10 **	3	75–100	0.003–0.005
Sprasteel 25 **	2	50– 75	0.003–0.005
Sprasteel 40 **	2	50– 75	0.003–0.005
Sprasteel 80	.. Grind	.....	.....
Sprasteel 120	.. Grind	.....	.....
Tin	3	150–250	0.005–0.007
Zinc	3	150–250	0.005–0.007

NOTES:

* To improve the machine finish on Sprabronze C and Sprabrass Y, apply a liberal coat of a mixture of one part cylinder oil plus one part kerosene to the sprayed metal with a brush, and allow to stand for 20 to 30 min. before machining.

** The same treatment applied to Sprairon A and Sprasteels 10, 25 and 40 will not improve the machine finish, but will help to prevent the tool from burning and permit higher machining speeds. The treatment is especially helpful in machining any hard sections that may be encountered at the ends of the sprayed sections or in corners.

*** The same treatment applied to copper and aluminum will give a slight improvement to the machine finish.

NOTE: Do not use this treatment on Metcoloy No. 1, nickel, monel, Sprabronzes A, M and P since it will result in a poorer rather than better machine finish.

work. The extreme hardness and wear resistance of tungsten-carbide tools reduce this difficulty to a minimum; furthermore, these tools give better finishes than can be obtained with high-speed steels, and some of the harder metals, which otherwise require grinding, may be machined readily. The setting of the tool is less critical when using tungsten-carbides, and in most cases the tool may be set directly on center for the rough cut, and, if necessary, raised very slightly above center for the finishing cut.

In machining the harder steels, such as the high-carbon high-chrome stainless steels and those above 0.40 percent carbon content, a certain amount of wear on the nose of the tool is inevitable. This may be minimized by polishing the tool with a hand stone before taking the finishing cut. A slight flat on the nose of the tool usually results in a better finish.

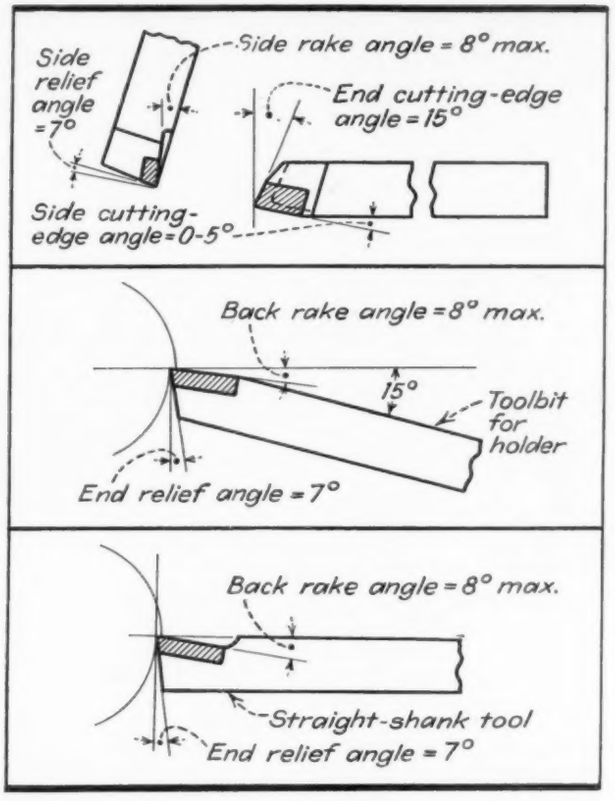
When machining sprayed monel metal, nickel and bronze, it is advisable to take an experimental cut while plenty of stock remains, and if the finish is not satisfactory, the tool should be raised above center, a little at a time, until a satisfactory finish is obtained. A certain amount of pressure must be exerted on the work by the nose of the tool in order to obtain a good finish on these metals. This results in a burnishing action which tends to densify and homogenize the surface. It is much easier to produce this effect with tungsten-carbides than with high-speed steel tools.

Many of the rules which apply to the general use of tungsten-carbide tools do not apply when used for machining sprayed metal. For example, it is seldom necessary when machining metallized surfaces to take a cut over 0.025 in. deep; hence, the side cutting-edge angle is of no importance, since all the work is done on the nose of the tool. Also, since sprayed metal lacks toughness, heavy cuts should not be taken. Consequently the transverse load is light and the tool requires less support than it would for general machine work.

Today, the tendency is to use grinding more extensively when equipment is available, not only for the hard metals, but also for relatively soft metals such as Metcoloy No. 1 and very soft metals such as Metco copper. This

RECOMMENDED SPEEDS AND FEEDS FOR TUNGSTEN-CARBIDE TOOLS

Metal	Surface speed, ft. per min. Roughing	Finishing	Feed, in. per rev. Roughing	Finishing
Sprabrass Y	250–300	300–350	0.006	0.002
Sprabronze C	250–300	300–350	0.006	p.002
Sprabronze M	250–300	300–350	0.006	0.003
Sprabronze P	250–300	300–350	0.006	0.003
Sprabronze T	250–300	300–350	0.006	0.003
Copper	250–300	300–350	0.006	0.003
Sprairon	75–100	100–125	0.006	0.003
Metcoloy No. 1	100–125	125–175	0.006	0.003
Metcoloy No. 2	30– 40	30– 40	0.004	0.003
Monel	200–250	250–300	0.004	0.002
Nickel	200–250	250–300	0.004	0.002
Sprasteel 10	75–100	75–100	0.006	0.003
Sprasteel 25	50– 75	50– 75	0.004	0.003
Sprasteel 40	30– 40	30– 40	0.004	0.003
Sprasteel 80	30– 40	30– 40	0.004	0.003
Sprasteel 120	30– 40	30– 40	0.004	0.003
Sprasteel 52E	30– 40	30– 40	0.004	0.003


Side relief angle = 7°
Side rake angle = 8° max.
End cutting-edge angle = 15°
Side cutting-edge angle = 0-5°
Back rake angle = 8° max.
15°
Toolbit for holder
End relief angle = 7°
Back rake angle = 8° max.
Straight-shank tool
End relief angle = 7°

CYLINDRICAL GRINDING—WET

Metal	Abrasive type	Abrasive grit size	Abrasive grade	Bond
Sprabronze C*:				
Rough and finish	Si-carbide	36–120	Soft or med.	Vitrified
Lustrous finish	Si-carbide	80–120	Soft or med.	Vitrified
Sprabronze M:				
Rough and finish	Si-carbide	36–46	Soft or med.	Vitrified
Lustrous finish	Si-carbide	60–80	Soft	Vitrified
Sprabronze T:				
Rough and finish	Si-carbide	36–46	Soft or med.	Vitrified
Lustrous finish	Si-carbide	60–80	Soft	Vitrified
Copper:				
Rough and finish	Si-carbide	36–46	Soft or med.	Vitrified
Lustrous finish	Si-carbide	60–80	Soft	Vitrified
Monel:				
Rough and finish	Si-carbide	46–60	Soft or med.	Vitrified
Lustrous finish	Si-carbide	60–80	Soft	Vitrified
Nickel:				
Rough and finish	Si-carbide	46–60	Soft or med.	Vitrified
Lustrous finish	Si-carbide	60–80	Soft	Vitrified
Metcoloy No. 1:				
Rough and finish	Si-carbide	46	Soft	Vitrified
	Al-oxide	400	Medium	Vitrified
Metcoloy No. 2:				
Rough and finish	Si-carbide	36–46	Soft or med.	Vitrified
Sprasteels 10, 25, 40, 80 and 120:				
Rough and finish	Si-carbide	36–46	Soft or med.	Vitrified

* Slow traverse (approximately ½ ft. per min.) and high work speed (approximately 140 surface ft. per min.) are absolutely essential in grinding Sprabronze C. High traverse rates cause the wheel to load badly and give a poor finish.

NOTES:

Wheel speeds, surface ft. per min	6,000–6,500
Work speed, surface ft. per min	80–90
Traverse speed, roughing, in. per min	36–48
Traverse speed, finishing, in. per min	8–16
Infeed:	
Roughing in	0.001
Finishing	Extremely light

Coolant most generally used is 50:1 to 40:1 soluble oil.

CYLINDRICAL GRINDING—DRY*

Metals	Surface speed, ft. per min. Work	Wheel	Feed, in per rev. Roughing	Finishing
Sprabronze C**	40–45	5000–6000	1/16–1/8	1/64–1/32
Sprabronze M**	40–45	5000–6000	1/16–1/8	1/32–3/64
Sprabronze T**	30–40	5000–6000	1/16–1/8	1/32–3/64
Copper***	30–40	5000–6000	1/16–1/8	1 32–3/64
Monel***	30–40	5000–6000	1/64–1/16	1/128–1/32
Nickel	30–40	5000–6000	1/64–1/16	1/128–1 32
Sprairon	30–40	5000–6000	1/16–1/8	1/32–3/64
Metcoloy No. 1	30–45	5000–6000	1/32–1/16	1/32–3/64
Metcoloy No. 2	45–125	5000–6000	1/64–1/16	1/128–1/32
Sprasteels 10, 25	30–45	5000–6000	1/16–1/8	1/32–3/64
Sprasteel 40	30–45	5000–6000	1/16–1/8	1/32–3/64
Sprasteel 80	30–45	5000–6000	1/16–1/8	1/32–3/64
Sprasteel 120	30–45	5000–6000	1/16	1/64–1/32

* For the first six metals listed use silicon-carbide wheels, vitrified bond, of No. 60 soft abrasive. For the last eight use silicon-carbide wheels, vitrified bond, No. 46 grit, very soft grade.

** It may be necessary with these metals to apply a light coat of machine oil between each cut to keep the wheel from loading.

NOTES:

Frequent dressing of the wheel when finish grinding Sprabronze and copper will promote faster cutting if more than one piece is to be ground, because of the loading that takes place on the wheel face from this type of material.

Recommended infeed per pass for rough grinding is 0.001 in. Use extremely light infeed for finishing.

permits greater accuracy and a higher degree of finish than can be obtained by machining.

Wet grinding presents no difficulties provided the right wheels are used at the speeds and feeds recommended in one of the tables. In the past, considerable difficulty has been experienced due to the lack of accurate information on the subject, and because most machinists and grinder hands are inclined to disregard the all-important fact that sprayed metal calls for different finishing procedures than parent metal of the same composition.

All sprayed metals tend to load grinding wheels. Consequently, for grinding them a wheel of relatively coarse grain and low bond strength is necessary so that it will break down with comparative ease.

Considerable difficulty has been experienced in dry grinding with the toolpost type of grinder. This difficulty was a matter of obtaining the proper grinder, developing the right type of wheels, and ascertaining the correct speeds of wheel and work. After considerable experimental work, these have been determined, and the results are given in one of the tables. It should be noted that the grinding recommendations tabulated in this article are for the

specific metals listed, and may not necessarily apply to others.

Flat surfaces that have been metal-sprayed should be finished whenever possible on a shaper or planer, instead of on a milling machine. The only necessary precautions are: (1) remove by filing or grinding any raised portions or overlapping flash and (2) take light cuts.

Conventional milling, contrasted to climb milling, may result in the cutter catching under uneven edges or overlapping flash and lifting or breaking the sprayed metal along the edges. Therefore, the edges of flat surfaces, especially keyways and splines, should be filed or ground before milling.

Flat surfaces that have been sprayed with a hard metal can be surface ground readily, using the wheels recommended herein for cylindrical grinding.

In general, the smallest inside diameter that can be metal-sprayed is 3½-in. Therefore, boring and grinding is a simple matter, based on the same technique outlined for external machining and grinding.

The hard ring and flash at corners or shoulders of metallized parts will be very much in evidence if there is a shoulder at the bottom of the bore, unless the corner is built up first with sprayed metal. This ring and flash should be removed with a blunt-nozed tool before proceeding with the finishing operations.

A fly cutter mounted in a piloted boring bar can be used successfully for machining internal surfaces. Reamers, especially the large production type, cannot be used unless the hole has been previously bored to within 0.005 in. of the finished size.

Inside diameters can be ground readily with internal grinding equipment. It is suggested that this is the best method of finishing any of the steels or alloys sprayed on internal surfaces.

Polishing sprayed metal requires no special skill on the part of the operator other than a realization that he is polishing a thin veneer which is bonded mechanically to the base metal. In general, the white metals, (tin, babbitt, zinc, and aluminum), are easy to polish. The red and yellow metals are a little more difficult due to hardness. Sprayed steels are extremely difficult to polish and should not be considered for any use that calls for a lustrous finish.

White and yellow metals should be applied to a thickness sufficient to allow from 0.006 to 0.012 in. for removal during rough and finish polishing. Extra metal should be applied to corners and edges to allow for excessive removal which may occur at such points during roughing.

The hazards or troubles which may be experienced in polishing are: (1) cutting through the coating with the edge or corner of a disk or wheel, (2) roughing off too much stock, (3) blistering due to local hot spots caused by too much pressure on a loaded wheel or disk, and (4) blistering due to heat generated during buffing or coloring.

In short, the troubles that occur in polishing are due mainly to the human element, and not to the sprayed metal or its characteristics. The sequence of operations on sprayed metals is the same as would be employed on ordinary castings. The surface of sprayed metal is similar in appearance and texture to a good casting, which means, of course, that the use of rag wheels and rough compounds must follow the use of abrasive wheels or disks.

White, yellow and red sprayed metals react favorably to wire brushing. An attractive matte finish is easily obtained without any of the troubles that are common to polishing. Hand and stationary rotating brushes are commonly used for small articles, while rotary brushes mounted on flexible shafts are used for large areas.

Spray metals, particularly the white metals used for corrosion resistance, should never be brushed with an ordinary steel brush, because particles worn from the brush will imbed themselves into the coating. The result will be rust streaks and spots that detrimentally affect the corrosion resistance effectiveness of the sprayed material.

Stainless steels, nickel and monel wire brushes are recommended, and while their initial cost is high, they give good service and excellent results. Wire diameter for soft metals such as tin and zinc, should be approximately 30 B&S gage. For brasses, bronzes and copper a slightly stiffer wire of 25 to 28 B&S gage will give good results.

Steels and steel alloys do not react to wire brushing, and nothing is gained. Nickel and monel can be wire brushed effectively, in which case a stiff wire of 25 to 28 B&S gage should be used.

METALLIZING WIRES*

METAL	CHARACTERISTICS AND TYPICAL APPLICATIONS
Metco aluminum	For common corrosion resistance — hot-water storage tanks, vegetable oil tanks bubble towers, gas-engine mufflers and wood patterns.
H. P. aluminum	For high-temperature corrosion resistance — carburizing boxes and pots; annealing boxes, trays and covers; furnace parts.
Metco 1% zinc aluminum	For resistance against salt-water corrosion of iron and ferrous alloys — seaplane fittings and landing gears, outboard motors and boat fittings.
Metco electrolytic zinc	High-purity zinc to resist atmospheric and fresh-water corrosion — refrigeration equipment, cold-water storage tanks, bridges, window sashes, pole hardware, spray-pond fixtures, condenser coils, mine cars, and conveyor equipment.
Sprababbitt A	Lead-free tin-base babbitt for heavy-duty bearings.
Sprababbitt L	Lead-base babbitt for light-duty bearings.
Metco lead	For general corrosion resistance — battery connecting straps, coatings to resist acid fumes.
Metco lead 7A (7–8% antimony)	For special corrosion resistance where a hard lead is required.
Metco tin	Pure block tin for tank linings and food-handling equipment.
Metco monel	All surfaces where monel coating is desired.
Metco nickel	All surfaces where nickel coating is desired.
Metco copper	Used principally for electrical conductivity and special work requiring copper surfaces.
Sprabrass Y	Brass surfacing and filling sand spots in brass castings.
Sprabronze C	Softest of the Sprabronzes for use where commercial-type bronze is satisfactory — armature window bushings and sand spots in castings.
Sprabronze M	Non-fuming bronze similar to M25. Recommended for special applications.
Sprabronze P	For use where phosphor bronze is recommended.
Sprabronze T	A tobin bronze and widely used for all types of metallizing — pump impellors, casings, plungers; water-wheel runners; armature window bushings; outside diameter of split motor bearings; outside diameter of airbrake valves; valve plugs.
Sprairon A	A high purity iron wire — pistons, press fits, mismachined castings, and blow holes in castings.
Sprasteel 10	For use where soft steel is required — armature shafts, press fits, mismachined parts, bearing surfaces of all kinds, inside diameters, pistons, valve stems.
Sprasteel 25	Harder than sprasteel 10 and used where good machinability is required. Same applications as Sprasteel 10.
Sprasteel 40	The hardest machinable sprasteel. Same application as Sprasteel 10.
Sprasteel 80	Most widely used hard steel for metallizing. Gives hard wear-resistant surface. Cannot be machined. Grind finish is good. Used for same applications as Sprasteel 10; also, crankshaft bearings, pump plungers, piston rods, turbine and generator shafts, seal rings.
Sprasteel 120	Almost as hard as Sprasteel 80, has higher specific gravity, and recommended where the greater density is worth the extra cost. Cannot be machined. Same applications as Sprasteel 80.
Metcoloy No. 1	An 18–8 low-carbon stainless steel with high corrosion resistance and good wearing qualities. Machine finish excellent — pump plungers, shafts, seal rings, gland casings, sleeves, impellers and castings; valve plugs; valve wedges; steam turbine casings; water-seal gland housings; low-pressure stationary blading; low-pressure packing sections; hydraulic rams.
Metcoloy No. 2	A high-carbon high-crome stainless steel with fair corrosion resistance and excellent wearing qualities. Recommended for same uses as Metcoloy No. 1, but where abrasion resistance is more important than corrosion resistance.
Metcoloy No. 3	A special wire developed for Metcolizing, a process that provides protection for ferrous materials against oxidation and scaling at elevated temperatures.

* These wires have been developed especially for metallizing to provide specific characteristics after spraying. This requires wires of correct temper, correct coil diameter, exceptionally accurate wire diameter, proper physical characteristics and precise chemical composition.

NOTE: Priority difficulties and delayed deliveries experienced today in procuring certain metallizing wires may seem to indicate that the benefits of the process can be obtained only with high priority ratings. While this may be true of the more critical metals, metallizing still may be employed as extensively as ever for all applications if coatings of iron and carbon steels are substituted for stainless steel and other strategic materials.

FLAME HARDENING WITH CITY GAS—4

Full-Automatic Set-Ups

R. F. APTER AND HARRY W. SMITH, JR., THE SELAS COMPANY

Flame-hardening machines have been developed in recent months for the rapid heat-treatment of parts made in large quantities

A LARGE NUMBER of fully mechanized installations have been made of gas-air flame hardening and flame annealing. For mass-production, such as the manufacture of automobiles, hardware, and other consumer goods, industry, by and large, wants to use complete flame-hardening machinery, rather than merely a combustion system and with makeshift handling of work pieces.

The first, and one of the most interesting, applications of the compacted or superheat gas-air flame-hardening burner was that devised for producing camshafts, Fig. 16, for two leading makes of automobiles—at a rate of 40 shafts per hour per production unit. Three fully automatic production units are already in operation in one Michigan plant. The problem in this case was to develop a hardened surface around the edge of each of the twelve cams as well as around the eccentric located between the second and third cams in the foreground of the illustration without heating the shaft itself, or the machined gear in the center of the shaft, to a temperature which would result in hardening when the entire piece was dropped from the firing zone into the oil quench.

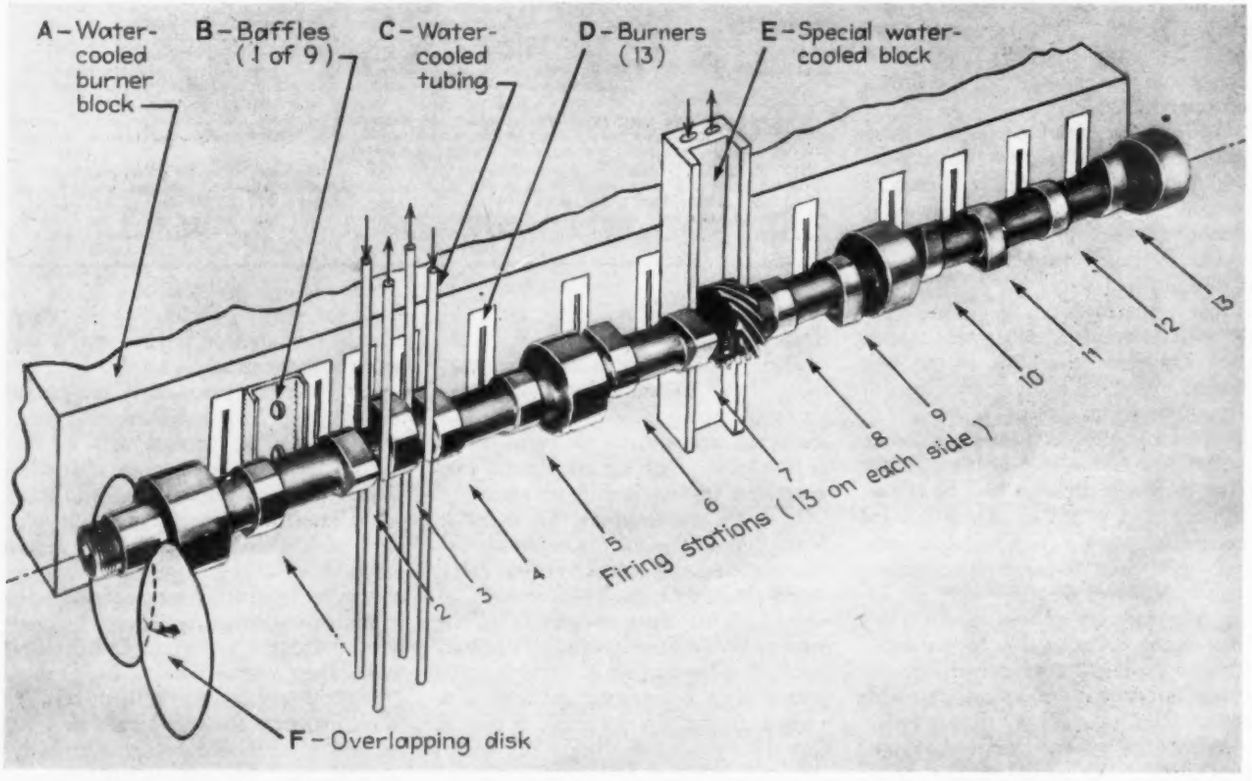


Fig. 16—"Compacted" combustion burners are employed in this gas-air flame-hardening machine for heat-treating camshafts. The 13 burners on each side of the work are closely fitted into a heavy water-cooled metal block *A* while baffles *B*, water-cooled tubing *C*, and water-cooled blocks *E*, are employed to protect the shaft from the superheated gases while the cam and eccentric surfaces are being heated. The burners *D* are spaced so that the heat is directed on the surfaces to be heated while the camshaft is supported on overlapping disks *F* at each end. These disks spin the shaft during the heating cycle, then the disks separate and the shaft drops into a quench tank

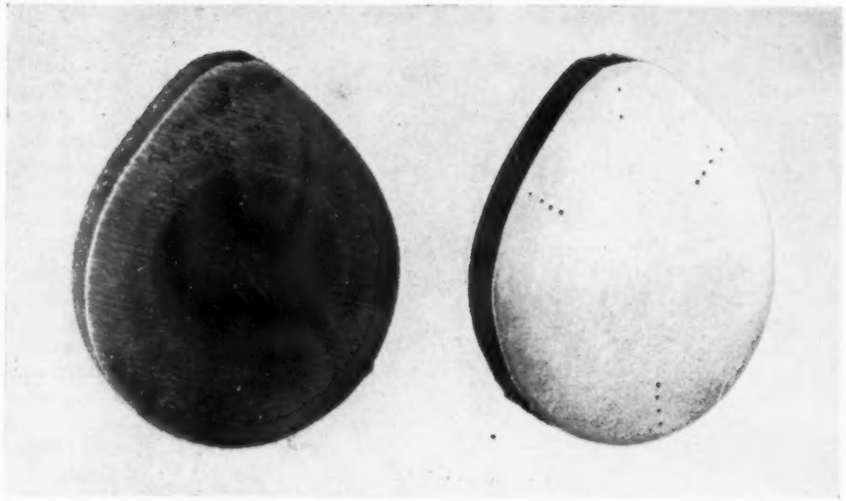


Fig. 17—These etched and Rockwell tested cam cross-sections, from a camshaft heat-treated in the set-up shown in Fig. 16, indicate the quality of the work performed in each of these machines

To achieve this end, 26 superheat or compacted combustion burners are used, one on either side of the rotating shaft at each cam or eccentric. The burners are so positioned that their slots are vertical (the shaft itself is horizontal) and within $\frac{1}{2}$ in. of the cam surfaces to be hardened. All of the 13 burners on either side of the work are closely fitted into a heavy water cooled metal block *A* drilled in devious patterns for the circulation of the coolant. In addition: auxiliary water-cooled blocks *E* protect the central machined gear from heating; special runs of water-cooled copper tubing *C* protect the shaft around the eccentric where the cam-eccentric-cam spacing is so close; and small formed sheet-metal baffles *B* are provided between each two adjacent burners to prevent "mushrooming" of the superheated gases when the largest radius of each cam or eccentric being treated is directly in front of a burner slot, and therefore the clearance between the outlet slot of the burner and the metal area under heat is minimal (as small as $\frac{1}{4}$ in.). These extra provisions for localizing the heat applied to the areas to be hardened are necessary only because of the large number of burners firing into the relatively small, virtually-inclosed space occupied by the shaft.

The processing cycle begins when a camshaft rolls down inclined loading rails, 90 sec. after its predecessor, and drops into the V formed by two overlapping disks *F* near each end of the firing station. This positions the shaft accurately between the two burner-studded blocks. The overlapping disks rotate automatically to spin the shaft between them and keep it spinning during the entire 85-sec. period for which the burners are thrown full-on.

When the firing cycle is completed and the hardening temperature of 1,550 F. has been attained on each cam or eccentric surface—and nowhere else—the overlapping disks supporting the camshaft separate and permit it to drop into the quench tank, whence it is fished out by hooks on a continuous chain elevator system. The entire production machine is housed under a hood so that the fumes from the quenching operation can be fan-exhausted. With a battery of three such machines in a row, all the operator has to do is load untreated shafts on the loading rails and remove the finished shafts from the oil-drainage table.

In this instance, two Selas combustion controllers, each with a capacity of 9,000 cu.ft. per hr. of premixed natural gas and air, supply the three machines and their total of 78 medium-size compacted square-nose combustion burners. The efficacy of the installation is attested to by a successful nine-month service record (before automotive production was interrupted by war)—as well as by numerous etched and Rockwell-tested cam cross-sections such as those shown in Fig. 17.

Flywheel Gears Hardened

A similar fully mechanized application of gas-air flame-treating is employed by another company in the hardening of small-tooth starter-flywheel automotive transmission gears. In this case, 20 superheat burners are arranged in a horizontal circle into which the 16-in. diameter gears are raised on a platform with a vertical axis. The platform and gear rotate at speeds of from 20 to 40 r.p.m. for a 50-sec. firing cycle to 1,500 F. Thereafter, the burners are automatically throttled to pilot gas-air consumptions, the turntable is

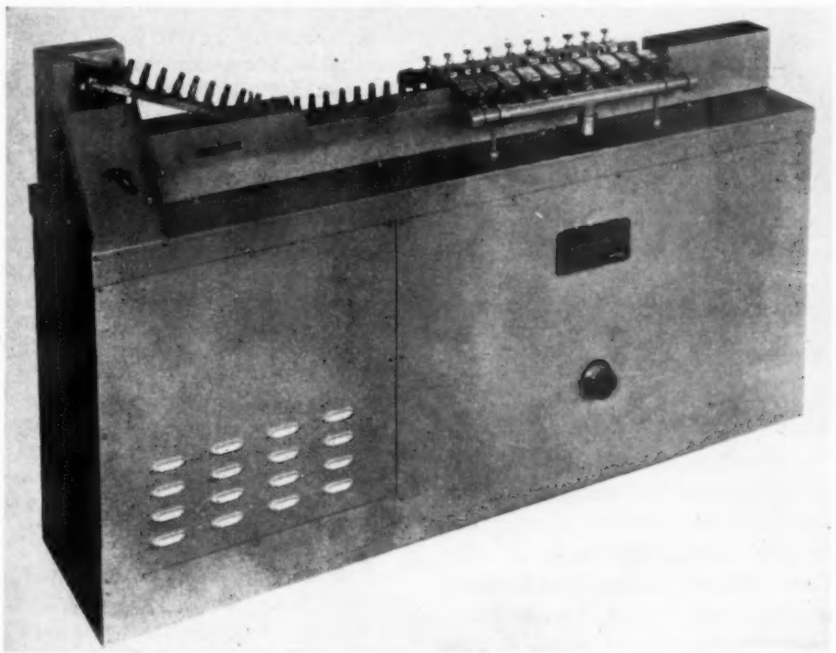


Fig. 18—This completely automatic flame-annealing machine anneals the threaded end of tie-rod balls used in automotive steering assemblies. During the entire cycle of this machine, the ball end of each piece is kept under the surface of a water bath so that its hardness is not affected by the annealing of the other end as it is traversed between compacted burners

lowered into the oil quench tank while still rotating for 17 sec., and the gear is finally lifted half way to the firing zone where it is unloaded and a fresh gear placed in position.

Again, all timing and part handling is automatic from the time that the operator loads a gear onto the cross-carriage which takes it into the flame-hardening machine and the time that the finished gear is released into a delivery chute. Two such units are in operation side by side. Each is completely housed in an insulated sheet-metal casing for the exhaust of fumes from the quench and for the sake of plant cleanliness and appearance.

The completely automatic unit shown in Fig. 18 is designed for a special flame-annealing job on a tie-rod ball used in automotive steering assemblies. The object of the treatment is to improve the strength characteristics of the threaded end of the small part without disturbing the hardness on the opposite ball end (established by prior cyanide-pot carburization). In order to accomplish this, the ball end of each piece is kept under the surface of a water bath during the major part of its travel from the right to the left side of the unit illustrated.

Parts are loaded at a rate of 1,500 units per hour on a slide along which they are pushed by pins carried on a bronze roller chain. While traversing this slide, the top threaded end is under heat from two opposed lines of ten medium-sized compacted combustion burners for a period of about 35 sec. During this time an annealing temperature of 1,200 F. is attained without losing the Rockwell C hardness of 58 to 60 on the ball end. A combustion controller, delivering about 18,000 B.t.u. per hour to each burner at a manifold pressure of somewhat over 1 lb. per sq.in., supplies fuel at constant pressure and air-gas ratio irrespective of all variable influences. It will be noted that, for 15 or 20 sec. after the actual firing is completed, the parts continue to travel horizontally with the ball end still in water, so that retained annealing heat on the threaded end will not "draw" the ball end during the early cooling period.

To achieve external burner cooling, and hence longer burner life, the burners fire up from horizontal at an angle of about 20 deg. and allow free air circulation between the bottom of each burner and the slanted roof of the water tank. The entire unit takes only 6 ft. by 1½ ft. of floor space. Other flame-annealing operations in the same plant, using similar gas-air burners, accomplish the annealing of the T-slotted ends of the shafts of automotive steering gear segments.

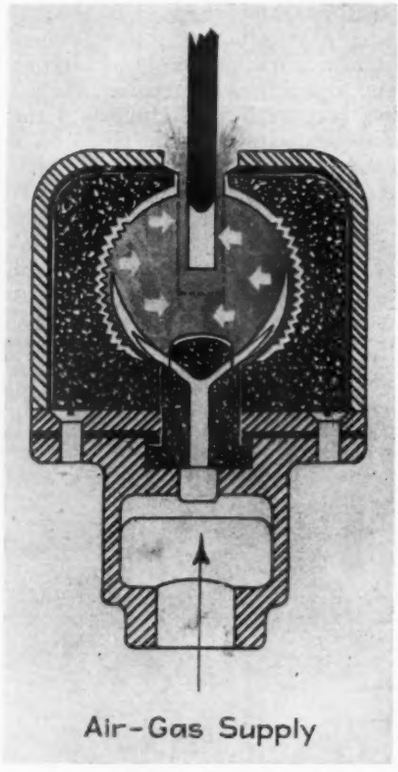


Fig. 19—Special burners combining the properties of compacted and radiant burners sometimes are made up for special applications. The burner shown was developed for heat-treating skate blades. The white area inside the burner and at the bottom of the skate blade indicate incandescent areas while the white arrows indicate radiated heat. The dotted lines outline the slots in the burner to permit passage of the blades

Used on Tank Sprockets

Still another installation, equally automatic, flame-hardens the bearing faces of the large heavy-section 13-tooth sprockets over which run the treads of modern tanks. In this instance the work and burners are both stationary during heat, so that burners can protrude in between the large sprocket teeth and harden their sides as well as their tips. Some 78 distributed combustion burners on each of two production machines assure uniform heating rates on all bearing surfaces. After the heating cycle each sprocket is automatically lowered into a water spray-quench ring and thereafter passed through an immersion quench to cool to room temperature. Two sprockets are handled side by side at one time in each unit.

Skate blades, bandsaws, hacksaws, valve balls, and valve shanks are all locally heated with the slot-type gas-air burner—because the narrow band of superheated combustion products can be made to heat only edge of the blades, the teeth of the saws, or the balls and shanks of the valves, in *rapid* passage past the burners—the mass and thickness of metal being small in the vicinity of the region to be hardened. In such a case, fast flood quenches or continuous dip quenches may be employed. The obvious object, of course, in all five cases, is to harden the working surfaces or edges and still retain full ductility, strength and machinability in the body of the work.

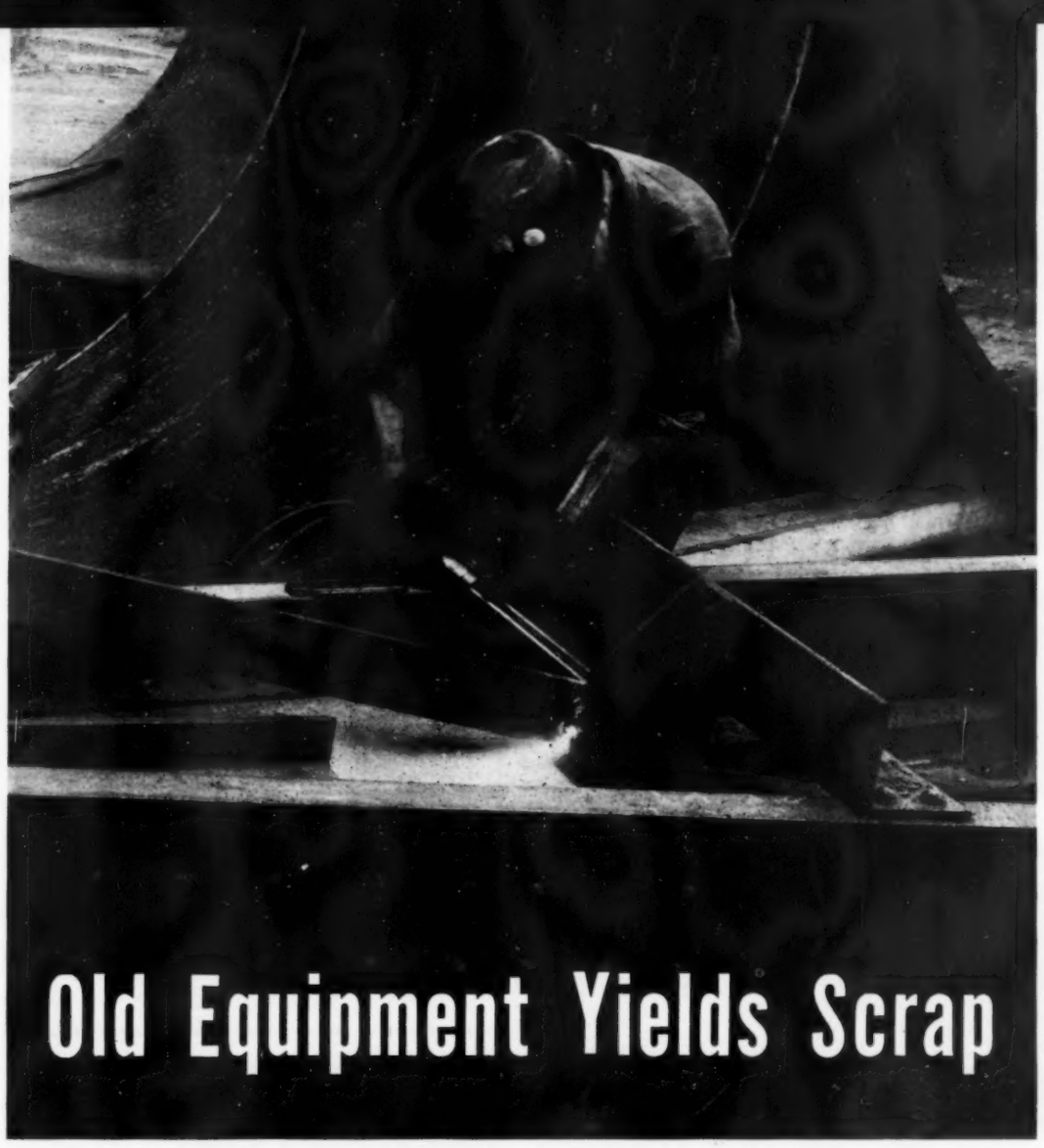
For some blade work special burners, such as shown cross-sectionally in Fig. 19, are used combining the virtues of compacted combustion and radiant combustion to achieve exceptionally high rates of transfer. Another special refractory-lined burner combining the virtues of radiant and distributed combustion and also permitting compacted combustion when closely faced to the work, is currently being developed to harden heavy lugs on military tank tread "grouser" plates in high-rate production.

Proper Training Increases Production

The importance of proper training is being made evident by the influx of women into the shop. Their usefulness depends so much on the way in which their work is made clear to them that it is difficult to over-stress the necessity for the best training possible, either before they start to work in the shop, or on the work they are to do.

In too many cases it is taken for granted that any good workman can show others how the job is done. Nothing could be farther from the truth. Few good mechanics are good teachers. It takes more than knowing how to do the job. You must not only know how to show the different moves of the job itself but be able to impress on the learner the importance of each step. Teaching is an art, or a trade, aside from merely knowing the things you want the learner to grasp.

A production superintendent recently expressed himself as surprised and pleased with the way in which women were handling the machines in the shop. But he also felt that if they had been properly trained he would be getting more production from the same shop equipment. Proper instruction can increase the output of our machine tools in many shops.



Old Equipment Yields Scrap

Steel girders and plates are cut down to sizes suitable for handling by scrap dealers

BY WALTER McCOMB, SUPERINTENDENT OF MAINTENANCE, THE M. W. KELLOGG COMPANY

When there's little hope of using machinery that has been lying around for years it can be cut up and used for scrap

IMPRESSED WITH the importance of gathering all available scrap and returning it to the mills, we have combed over our list of stored equipment and marked a great deal of it for scrap. Two men have been assigned to cutting up this material into scrap sizes and trucking it to our regular scrap piles where it is loaded into cars for shipment.

Our policy during this vital period is, and will be, anything not in service in the plant nor planned for future service will be disposed of now to help win this war as quickly as possible.

We have always been conscious of conserving scrap and, consequently, have been careful of obsolete machinery—the result being that we have held several pieces of equipment and a large amount of structural steel shapes in and around our yard for years. This system has proven to be profitable as, at times, we have found it necessary to make rapid changes in our buildings and tool set-up to conform to our particular type of work.

Machining Scrap Segregated

A total of about 60 tons of obsolete machinery has recently been scrapped. Some of it had been on hand for 15 years. This equipment included an X-ray machine, a 12½-ton steam roller, a 20-ton waste-heat boiler and a number of steel girders.

We use a great deal of steel plate and piping as we are fabricators of pressure vessels and piping, therefore, the salvaging of scrap material is a part of our business. The internal parts of tanks, towers and condensers which we build are often made of copper, brass or other non-ferrous metals. These metals, as well as other steels, require a certain amount of machining and this machining creates drillings and turnings which must be separated according to the type of metal and finally returned to the mills as scrap.

The steel turnings are placed in a large elevated bin alongside of one of the railroad tracks. This bin has a capacity of about one and a half carloads and the bin is loaded and unloaded with the aid of a magnet. Nonferrous scrap is packed in open steel drums and we have found this a most convenient means of handling such materials.

IDEAS FROM PRACTICAL MEN

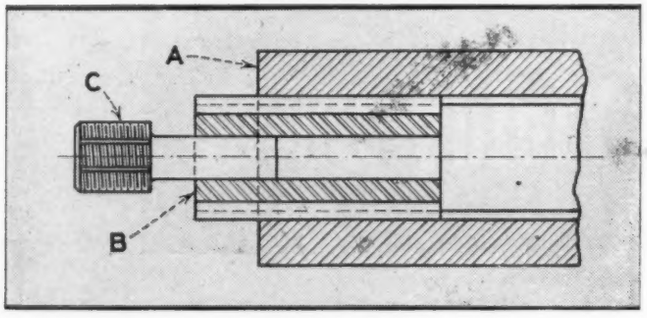
Fine Threads in Aluminum and Brass

BY CHARLES T. STOEFFLER

Difficulty was encountered in tapping fine pitch threads in aluminum and brass. Threads would strip, and, when it was a full thread, it would be bell mouth.

The problem was solved by the attachment shown in the drawing. Two $\frac{1}{4} \times \frac{1}{8}$ in. keyways were cut opposite each other through the hole of a long, flanged toolholder which was mounted on a station of the hexagon turret with the hole of the holder lined up within 0.0005 in. with the spindle. If this holder is not lined up properly, the operation will be a failure.

Sleeve *B* was made $3\frac{1}{2}$ in. long, with the hole and outside diameter accurately concentric. The hole

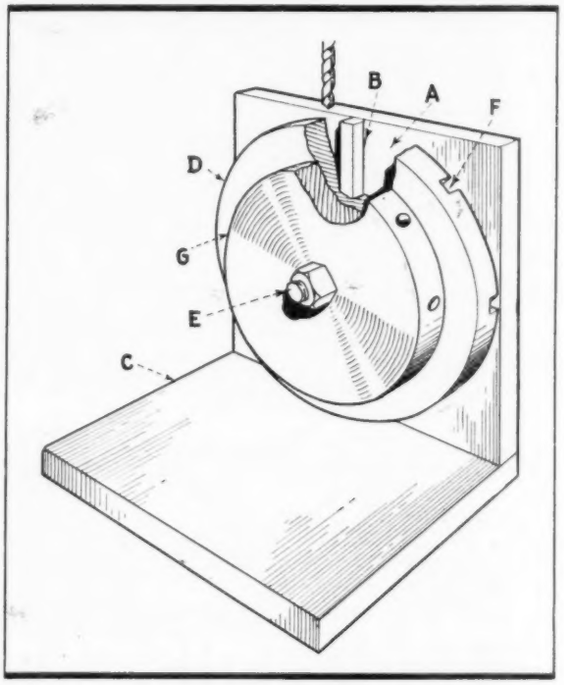


Fine pitch threads in aluminum and brass can be tapped without stripping by using a work holder of this type, which puts no load on the tap

in the sleeve was made to fit closely over the shank of tap *C*, while the outside diameter was a sliding fit with toolholder *A*. Two $\frac{1}{4}$-in. wide keys fitted to the outside diameter of the sleeve lined up with the two keyways in the hole of the toolholder.

The sleeve was soldered to the shank of the tap and the unit inserted into the hole of the flanged toolholder.

In operation, the hole in the part is bored to the correct size for tapping and the turret brought forward until the tap with the lead ground to the required standard, engages the edge of the hole. Slight pressure on the handle of the turret causes the tap to take hold and as it cuts the thread, the sleeve feeds out of the holder while the turret remains stationary. There is no chance for the thread to strip as there is no load on the tap during this operation. When the tap reaches the proper depth, the spindle is reversed and the tap backs out of the hole, the sleeve re-entering the holder.



This drill press fixture facilitates drilling radial holes in the edges of round disks

Drilling Radial Holes in Disks

BY JOHN E. HYLER

When disks of different diameters are to have evenly spaced holes drilled around their rims in radial formation, the fixture shown in the drawing makes it possible to do the work without the use of a dividing head.

Plate steel *A* is fitted with spline-type member *B*, preferably by milling a groove across *A*, setting the spline in place and tack welding. Care should be used not to get an excessive amount of welding in the corner. Plate *A* is welded to another plate, *C*, with the angle between held to a right angle. This angle plate is clamped to the drill press table.

Circular master plate *D* can be made as large in diameter as the largest disks to be drilled. This plate is drilled and counterbored in the center. The counterbore is sufficiently deep to receive the head of bolt *E*. Grooves *F* are to fit over the spline *B* of the angle plate and must be a bit deeper than the projection of the spline. These grooves can be machined on a milling machine, indexing the master plate so that the four grooves will be evenly spaced and will pass through the center of the plate. These grooves should be relieved at the corners using an angle cutter, so that they will not interfere with the small welding bead left alongside of spline *B*.

Workpieces *G* are centrally drilled, the hole through the master plate *D* having been drilled the same diameter as the center hole required in the workpiece. Thus, by slipping one workpiece over the end of bolt *E* and running a nut on to the end of the bolt to hold workpiece and disk together, the two may be handled as a unit at the drill press.

The grooves across the master disk may now be set over spline *B* so that the disk rests against plate *C*. It is clamped to the plate and a hole drilled in the edge of the workpiece. The assembly is then shifted so that the next groove engages the spline of the second hole drilled. Eight holes evenly spaced around the disk will be drilled with the grooves illustrated. Other arrangements can be secured by milling grooves in corresponding positions in the master disk.

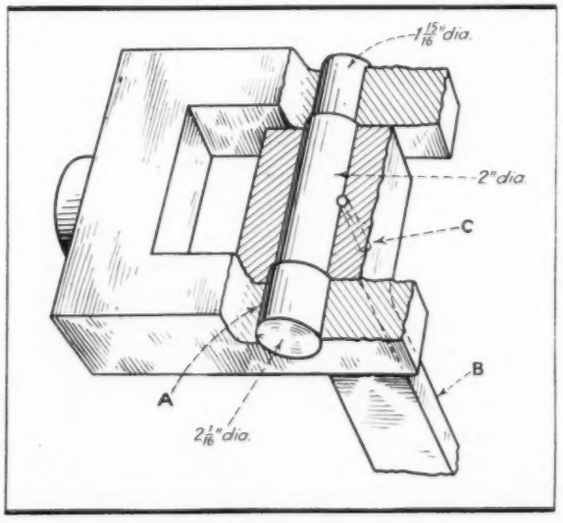
Step-Cut Valve Crosshead Pin

BY A. H. CARROLL

The valve crosshead pin *A* at the top of the combination lever *B* of a Walschaert valve gear is usually straight. It is held in the combination lever by a tapered pin *C*, and turns freely in the bearings of the valve crosshead.

Machinists frequently have difficulty in pushing this pin through the crosshead and combination lever, as well as in aligning the tapered pin hole while the gear is being assembled. Our road decided it would be easier to enter the pin in the combination lever and inside leg of the crosshead if the pin were step cut instead of straight. Therefore, one valve crosshead fit was made $\frac{1}{16}$ in. larger than the combination lever fit, while the other valve crosshead fit was made $\frac{1}{16}$ in. smaller than the combination lever fit. Bronze bushings were made and pressed into the valve crosshead to correspond to the new pin.

By doing this the arduous procedure of driving a straight pin through three fits was eliminated. Furthermore, the tapered pin hole in the combination lever must align with the slot in the pin when the shoulder comes in contact with the combination lever and the pin is turned so the slot is vertical. These three-size pins are now being used on all our locomotives equipped with Walschaert gear.

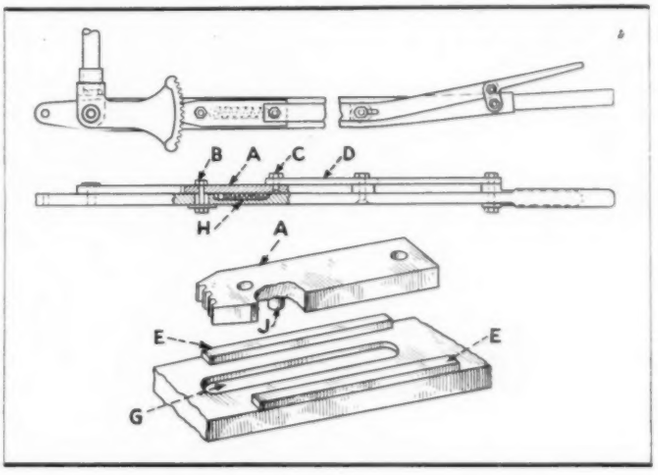


This step-cut pin permits quick assembly of the combination lever in valve crossheads of the Walschaert locomotive valve gear

Eliminate Lost-Motion in Throttle Levers

BY ARTHUR HAVENS

Routine repairs are made to locomotive throttle levers when needed, but little attention is paid to improving their operation. This is particularly true of the type of levers shown in the drawing where latch *A* is held in place by bolt *B* through the throttle lever and stud *C* in the latch-operating lever *D*. Several engineers on our road complained that when the latch becomes loose it allows movement



Some locomotive throttle levers are so designed that when the latch becomes worn it is difficult for the latch to engage itself easily in the quadrant. This can be overcome by welding guides on the throttle lever to maintain alignment of the latch

sideways and prevents easy engagement of the latch and the throttle quadrant.

It was obvious that to eliminate looseness and lost motion, the latch had to be confined on the lever without interfering with freedom of movement in and out of the quadrant. This was accomplished by welding $\frac{5}{16} \times \frac{5}{16}$-in. strips *E* on the top and side of the lever for the entire length of the latch movement. The width of the lever was not increased. All worn places on the lever were rebuilt by welding, and slot *G* machined for the new latch.

The new latch is of necessity narrower than the original one, because it has to fit between $\frac{5}{16}$-in. strips *E* welded to the throttle lever; however, strength is added by making the new latch thicker than the old one. The same closing medium is used, namely, a coil spring *H* in slot *G* under the latch. Lug *J* on the bottom of the latch is machined to

slide freely in the slot *G* with as little lost motion as possible. Machining the lug a few thousandths large and filing to fit prevents it from binding when opening and closing the latch.

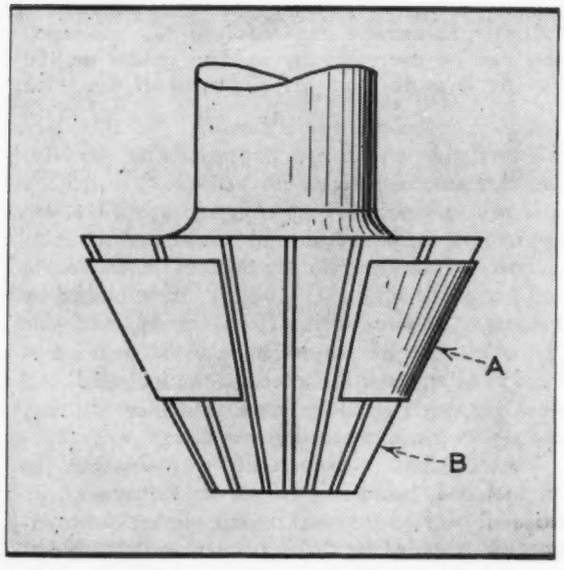
The original latch operating rod was light and of insufficient strength to perform the duties imposed upon it. This necessitated a new rod. It was made from a piece of $\frac{3}{8}$-in. round stock flattened to $\frac{5}{16} \times \frac{7}{16}$ in. with a few blows of a steam hammer. The boss on the latch end of the new operating rod was made from a piece of $\frac{1}{4} \times 1$-in. iron welded to the rod and ground to the correct shape. After the length of the rod was determined, a piece of $\frac{1}{2} \times 1$-in. square iron was welded to the handle end. This was ground to shape, drilled and reamed for the handle pin. Bends in the latch operating lever were made by bolting the latch in place, heating the rod with an oxyacetylene torch, and making the bends where needed; thus, the bends were placed in exact location.

Sheet Metal Stops Chattering Countersink

BY F. S. McGIBBON

The last operation on a large and valuable brass casting was to countersink four 1-in. holes to a given depth. Three of the holes had been finished, but on the last hole the countersink started to chatter. In an effort to remedy this the machine was operated at different speeds, but the chattering continued.

A thin piece of sheet metal *A* was placed around the countersink, leaving only three teeth exposed. The tool was again brought in contact with the work and revolved slowly. In three revolutions the chattering stopped. The sheet metal band was removed, and the hole finished to the proper depth without further difficulty from chattering.



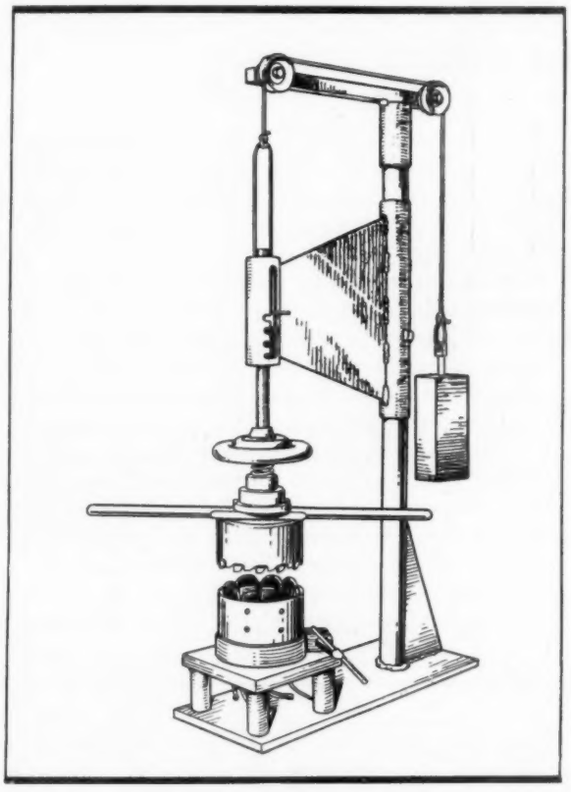
A thin piece of sheet metal placed around countersink *B* stopped chatter in countersinking a hole in a large brass casting

How to Remove Varnish from a Bracket Fit

BY C. T. PACKER
Westinghouse Electric & Manufacturing Co.

After parts have been dipped in varnish and baked it is necessary to remove part of it from the metal. This is sometimes done by sanding or buffing but if the parts are identical and in large numbers, quicker and more thorough methods can be found.

A hollow mill supported from a stand and counterbalanced for ease of operation is used to remove varnish from the bracket fit of small motor frames. The cutter is lowered until a pin in the slide nut engages in the lowest notch in the guide. The cutter is rotated manually and the desired pressure is supplied by turning a handwheel. When the bracket fit has been properly cleaned the pressure is released; the slide nut is disengaged from the pin, and the cutter is pulled upward by the counterbalance.



A time saving of 70 percent over the old method of cleaning varnish off bracket fits is made by use of this hollow mill

A shell cutter is required for each frame size. A side clearance on the teeth is omitted to prevent the diameter of the frame fit from being affected. To keep the depth of the cleaned surface constant four of the twelve teeth have no back clearance. A spring under the handwheel cushions the cutter to permit starting on irregular surfaces, thus compensating for any misalignment.

The Working of National Emergency Steels

WITH the advent of war, maximum utilization of steel-producing facilities became a necessity and special steel analyses to fit each shop condition came to an abrupt end. Upon the request of the War Production Board, the reduction and unification of steel analyses were begun in January of this year by an informal committee of metallurgists selected from the technical committees of the American Iron and Steel Institute, the Society of Automotive Engineers and interested manufacturers. The sixteen original National Emergency steel analyses resulted.

In July the War Production Board requested this committee to devise a new series of National Emergency steels which would further conserve strategic alloying elements. A study was made of (1) the availability of silicon and manganese, (2) the average quantity of alloying elements recoverable from scrap, (3) the effect of increases in manganese and silicon concontents on the general properties of steel, (4) the elements and ranges of elements which might be used to duplicate the hardenability of the steels now in use, (5) the effect of combining several elements in small quantities upon the properties of steel at various hardness and strength levels, and (6) whether the steels selected would suffice for general application.

Various combinations of predetermined compositions containing different amounts of manganese, silicon and chromium, as well as manganese, silicon, nickel, chromium and molybdenum were manufactured and compared by hardenability tests. As a result, a new series of NE steels has been established which have hardenability values comparable to steels used previously. The compositions are listed in one of the tables.

It should be noted that the regular AISI and SAE 1300 series (carbon-manganese), the 9200 series (silicon-manganese and silicon-manganese-chromium) and the 52100 series (carbon-chromium) have been included in the new NE steels.

Four manganese-molybdenum steels, NE 8020, NE 8022, NE 8339 and NE 8442, and the NE 8600 and NE 8700 series were included at the request of the War Production Board.

The newer National Emergency steels consist of the NE 9400, 9500 and 9600 series. The first two were established to utilize strategic alloying elements found in scrap metal. In order to arrive at the most promising compositions and effect the greatest conservation of nickel, chromium and molybdenum, a survey was made of the alloy steel producers to ascertain the average recovery of alloying elements in scrap. It was found that it was possible to prepare a series of steels containing 0.20 to 0.40 percent each of nickel and chromium and 0.08 to 0.15 percent molybdenum, thus using a minimum amount of virgin alloy, provided increases in silicon and manganese could be permitted to secure the proper equivalent hardenability values to those steels which were to be replaced. Permission for the increased use of silicon and manganese was granted by the War Production Board and arrangements were made to melt experimental heats.

In the table showing the composition of new NE steels, no low-carbon carburizing grades of NE 9600 (manganese-silicon-chromium) steels have been listed. That was done because an increase in manganese and chromium contents, sufficiently high to approximate the hardenability of the standard steels to be replaced, would cause difficulties in present manufacturing procedures. Moreover, the manufacture of such steels would require large quantities of carbon-free ferromanganese and carbon-free ferrochromium. Those products used in large quantities pose problems in both production capacities and availability.

The fact that the physical property test data which have been accumulated to date on the NE 8000 series steels conforms in all essential respects to the ordinary physical property test data available for standard steels leads to the conclusion that the new NE steels will exhibit similar characteristics.

In one of the tables will be found a list of AISI-SAE steels and NE 8000 series steels, grouped according to their average hardenability values, together with the alternate or alternates having approximately the same hardenability values. Uses of the steels, based on application of the steels for which the new NE steels can be substituted, are also shown in this table. Additional information of the application of NE steels are given in three other tables.

LIMITATIONS ON ELEMENTS

When establishing the NE 9400, 9500 and 9600 series, it was found necessary to apply the following limitations on alloying elements:

Manganese—When the carbon con-

This section was made possible through information obtained from the following sources:

Allis-Chalmers Manufacturing Company
American Iron & Steel Institute
American Society for Metals
American Society for Testing Materials
Bethlehem Steel Company
Carboloy Company, Incorporated
Carnegie-Illinois Steel Corporation
The Carpenter Steel Company
Climax Molybdenum Company
Crucible Steel Company
Doall Company
Firth-Sterling Steel Company
Fiske Brothers Refining Company
The Geometric Tool Company
Gisholt Machine Company
Gulf Oil Corporation
Henry Disston & Sons, Incorporated
E. F. Houghton & Company
The International Nickel Company
Landis Machine Company
National Twist Drill & Tool Company
Norton Company
Republic Steel Corporation
Rotary Electric Steel Company
Society of Automotive Engineers
Shell Oil Company
D. A. Stuart Oil Company
Sun Oil Company
The Texas Company
Victor Saw Works, Incorporated
Wells Manufacturing Company
Wisconsin Steel Company
Youngstown Sheet & Tube Company

COMPOSITION OF ORIGINAL NE STEELS

Steel	Carbon	Manganese	Molybdenum	Nickel	Chromium
NE 8024	0.22–0.28	1.00–1.30	0.10–0.20	.....	.....
NE 8124	0.22–0.28	1.30–1.60	0.25–0.35	.....	.....
NE 8233	0.30–0.36	1.30–1.60	0.10–0.20	.....	.....
NE 8245	0.42–0.49	1.30–1.60	0.10–0.20	.....	.....
NE 8339	0.35–0.42	1.30–1.60	0.20–0.30	.....	.....
NE 8442	0.38–0.45	1.30–1.60	0.30–0.40	.....	.....
NE 8447	0.43–0.50	1.30–1.60	0.30–0.40	.....	.....
NE 8547	0.43–0.50	1.30–1.60	0.40–0.60	.....	.....
NE 8620	0.18–0.23	0.70–0.95	0.15–0.25	0.40–0.60	0.40–0.60
NE 8630	0.27–0.33	0.70–0.95	0.15–0.25	0.40–0.60	0.40–0.60
NE 8724	0.22–0.28	0.70–0.95	0.20–0.30	0.40–0.60	0.40–0.60
NE 8739	0.35–0.42	0.75–1.00	0.20–0.30	0.40–0.60	0.40–0.60
NE 8744	0.40–0.47	0.75–1.00	0.20–0.30	0.40–0.60	0.40–0.60
NE 8749	0.45–0.52	0.75–1.00	0.20–0.30	0.40–0.60	0.40–0.60
NE 8817	0.15–0.20	0.70–0.95	0.30–0.40	0.40–0.60	0.40–0.60
NE 8949	0.45–0.52	1.00–1.30	0.30–0.40	0.40–0.60	0.40–0.60

NOTE: The following additional element specifications apply to all the basic openhearth steels listed above — Phosphorus, 0.040 percent maximum; Silicon, 0.20–0.35 percent; Sulphur, 0.040 percent maximum.

tent required in the steel is 0.25 percent or higher, no limitation is recommended for the use of ferromanganese. When the manganese content is over 1.30 percent but not over 1.60 percent, the carbon content should be limited to a minimum of 0.20 percent. When the manganese is over 1.00 percent but not over 1.30 percent, the carbon content should be limited to 0.18 percent. Those recommendations apply to steel containing no chromium. When chromium is present the recommendations must be modified to conform with those made for steels with higher carbon.

Silicon—The silicon content of the new NE steels was arbitrarily placed at 0.60 percent maximum, although the maximum permissible limit has been left open for use with other chemical compositions which might require a higher silicon content.

Nickel and Chromium—For the new NE steels the nickel and chromium contents were set at 0.20 to 0.40 percent each, although the NE 9500, NE 8600, and NE 8700 series each contain 0.40 to 0.60 percent nickel and chromium and were retained in the current list of National Emergency steels at the request of the War Production Board, as shown on the opposite page.

Molybdenum—In the new steels the recommended range for molybdenum is 0.08 to 0.15 percent, except in the case of the NE 9500 series which contains 0.15 to 0.25 percent molybdenum. NE 8020, NE 8022, NE 8339, NE 8442, containing higher percentages of molybdenum were retained in the new list at the request of the War Production Board.

Vanadium and Tungsten—Both vanadium and tungsten are under restrictions in War Production Board Order M-21a and subsequent modifications, and no recommendations were considered necessary.

Special Addition Agents—Special alloying compounds known as addition agents or reaction alloys, which contain varying amounts or combinations of boron, silicon, titanium, vanadium, zirconium and other elements, have been used in some types of steel with rather remarkable results. At the present time, their use appears to be best suited for those applications where performance of the end product is the requirement rather than where a definite chemical composition specification is mandatory. A special committee composed of members of the Technical Committee on Alloy Steel of American Iron and Steel Institute, producers of the special addition agents, and those consumers of such steels which have had experience in their use is now working on a comprehensive report concerning the use of such agents.

THE SELECTION OF A STEEL

The National Emergency Steels may be divided into three general classes:

1. The carburizing steels containing up to 0.28 percent carbon, which are used where a very hard wearing surface is to be obtained accompanied by good toughness and shock resistance in the core of the finished part.

2. So-called "semi-thorough hardening" grades containing from 0.28 to 0.40 percent carbon. These steels include the water- and oil-hardening types, and are generally used in tensile-strength ranges from 100,000 to 150,000 lb. per sq. in., with Brinell hardness ranging from 200 to 300. Some are used in the normalized, or normalized and tempered condition, with tensile strengths of 65,000 to 105,000 lb. per sq. in.

3. The so-called "thorough hardening" grades containing more than 0.40 percent carbon, all of which are oil hardening. They may be divided into the following four classes:

(a) Those used in the full-hardened state, tempered to about 400 F. with resultant Brinell hardnesses of 550–600 and tensile strengths of 275,000–300,000 lb. per sq. in.

(b) Those treated to Brinell hardness number values of 350 to 450 with tensile strengths of about 175,000 to 225,000 lb. per sq. in.

(c) Those treated to Brinell hardness number values of 260 to 350 with tensile strengths of about 125,000 to 170,000 lb. per sq. in.

(d) The high-carbon 52000 series used for bearing steels which have unusually high resistance to wear. Such steels are used at the maximum hardness obtainable for the section involved.

Recommended applications for these various grades, and substitutions for standard AISI and SAE steels, are shown in the tables, some of which include recommended heat treatments and resulting physical properties. The latter are given to aid in making a proper selection of the various steels.

From the physical property and hardenability data on the NE carburizing grade now available, it has become apparent that NE 8720 will do a satisfactory job as as all-around carburizing steel. It is comparable to the regular 4620 grade.

Apparently NE 8715 will, without too much hazard, replace the high alloy steels up to, but not including, SAE 3312 and 2515.

In the oil-hardening grades, NE 8739 compares favorably with 4140, NE 8949 compares favorably with 4340, and NE 8749 will in ordinary sections replace the highest alloy steels without great hazard.

The carburizing and medium carbon grades of the NE 9400 series will serve in sections up to 1 in. or 1½ in. on all

the lower alloy applications, starting with SAE 4023 through 5120, 4120, 3120, and 4620. The oil-hardening grades in the NE 9400 and 9500 series will find a similar field in replacing the 0.40 percent carbon steels of the type just mentioned.

The effect of small amounts of chromium, nickel, and molybdenum are greater than expected, especially by those accustomed to working with higher additions of one of these elements. For example, an analysis having the composition 0.23 percent carbon, 0.82 percent manganese, 0.26 percent nickel, 0.34 percent chromium, and 0.13 percent molybdenum (NE 9422) gave hardenability within one point Rockwell C of that obtained from 2320 in sections equivalent to a 4-in. round. For ordinary applications, such a steel can replace a higher alloy steel.

The 0.20–0.40 nickel, 0.20–0.40 chromium and 0.08–0.15 molybdenum steels (NE 9400 series) can be used for truck gears having sections up to ¾ in. NE 8620 (high side) or NE 8720 is being applied over a wide range of parts and sizes replacing SAE 4620, 6120, 2320, 2515, and even 4320 in light sections. NE 8715 is being used to replace the higher alloys, such as SAE 2515, 4320, 4820 and to some extent 3312, in light sections.

The oil-hardening grades cover about the same field of SAE analysis. NE 8739 is becoming a popular gear steel, because of exceptional machining qualities, coupled with maximum uniformity from heat to heat, and the very minimum distortion in heat treating.

The manganese - silicon - chromium steels (NE 9600 series) can be used for many applications in their normalized condition, and when heat-treated they compare favorably with the standard SAE 5100 series.

The NE 9200 series are used for large flat and helical springs, as well as for metal-working tools, including chisels, rivet sets for hot work, solid shear blades, and press tools for shearing, blanking and punching.

The NE 52100 series is primarily a bearing steel, and because of its deep-hardening characteristics is applicable for races and balls or rollers for anti-friction bearings.

The impression should not be gained that the SAE and AISI manganese-molybdenum (4000 series) or other noncritical steels are not to be used. But if conditions beyond control of steel producers favor the melting of NE chromium-nickel-molybdenum types because of the scrap being used today, then such conditions must be recognized and given proper consideration when selecting a steel.

The substitutions mentioned in both the text and tables of this article may require adjustments in plant practice. Consideration involving heat-treatment technique and machining practice have played just as important a part in the choice of high-alloy SAE and AISI steels as their mechanical properties. These characteristics are not subject to accurate definition because the variables involved in fabricating technique are exceedingly complex. They differ from one steel to another, and sometimes between two heats of the same steel. In this regard, the National Emergency steels have the desirable feature of uniformity in processing. This is due to the fact that all hardening elements are shown in the analysis and controlled.

Hardenability values have been added to the table of National Emergency steels listed below. They represent diameters of round bars, grain size 6, which will harden to the center.

CURRENT NATIONAL EMERGENCY STEELS

Steel No.	Carbon	Manganese	Silicon	Molybdenum	Chromium	Nickel	Hardenability*
Carbon-manganese steels							
NE 1330	0.28–0.33	1.60–1.90	0.20–0.35	.....	.....	.....	1.71
NE 1335	0.33–0.38	1.60–1.90	0.20–0.35	.....	.....	.....	1.83
NE 1340	0.38–0.43	1.60–1.90	0.20–0.35	.....	.....	.....	1.96
NE 1345	0.43–0.48	1.60–1.90	0.20–0.35	.....	.....	.....	2.07
NE 1350	0.48–0.53	1.60–1.90	0.20–0.35	.....	.....	.....	2.18
Manganese-molybdenum steels							
NE 8020	0.18–0.23	1.00–1.30	0.20–0.35	0.10–0.20	.....	.....	1.47
NE 8022	0.20–0.25	1.00–1.30	0.20–0.35	0.10–0.20	.....	.....	1.56
NE 8339	0.37–0.42	1.30–1.60	0.20–0.35	0.20–0.30	.....	.....	2.49
NE 8442**	0.40–0.45	1.30–1.60	0.20–0.35	0.30–0.40	.....	.....	3.02
Nickel-chromium-molybdenum steels							
NE 8613	0.12–0.17	0.70–0.90	0.20–0.35	0.15–0.25	0.40–0.60	0.40–0.60	2.51
NE 8615	0.13–0.18	0.70–0.90	0.20–0.35	0.15–0.25	0.40–0.60	0.40–0.60	2.57
NE 8617	0.15–0.20	0.70–0.90	0.20–0.35	0.15–0.25	0.40–0.60	0.40–0.60	2.62
NE 8620	0.18–0.23	0.70–0.90	0.20–0.35	0.15–0.25	0.40–0.60	0.40–0.60	2.94
NE 8630	0.28–0.33	0.70–0.90	0.20–0.35	0.15–0.25	0.40–0.60	0.40–0.60	3.52
NE 8715	0.13–0.18	0.70–0.90	0.20–0.35	0.20–0.30	0.40–0.60	0.40–0.60	2.81
NE 8720	0.18–0.23	0.70–0.90	0.20–0.35	0.20–0.30	0.40–0.60	0.40–0.60	3.21
NE 8722	0.20–0.25	0.70–0.90	0.20–0.35	0.20–0.30	0.40–0.60	0.40–0.60	3.34
NE 8735	0.33–0.38	0.75–1.00	0.20–0.35	0.20–0.30	0.40–0.60	0.40–0.60	4.14
NE 8739	0.35–0.40	0.75–1.00	0.20–0.35	0.20–0.30	0.40–0.60	0.40–0.60	4.26
NE 8740	0.38–0.43	0.75–1.00	0.20–0.35	0.20–0.30	0.40–0.60	0.40–0.60	4.40
NE 8744	0.40–0.45	0.75–1.00	0.20–0.35	0.20–0.30	0.40–0.60	0.40–0.60	4.55
NE 8749	0.45–0.50	0.75–1.00	0.20–0.35	0.20–0.30	0.40–0.60	0.40–0.60	4.80
NE 8949**	0.45–0.50	1.00–1.30	0.20–0.35	0.30–0.40	0.40–0.60	0.40–0.60	7.50
Silicon-manganese and silicon-manganese-chromium steels							
NE 9255	0.50–0.60	0.70–0.95	1.80–2.20	.....	.....	.....	1.83
NE 9260	0.55–0.65	0.75–1.00	1.80–2.20	.....	.....	.....	1.89
NE 9262	0.55–0.65	0.75–1.00	1.80–2.20	.....	0.20–0.40	.....	3.21
Manganese-silicon-chromium-nickel-molybdenum steels							
NE 9415	0.13–0.18	0.80–1.10	0.40–0.60	0.08–0.15	0.20–0.40	0.20–0.40	2.22
NE 9420	0.18–0.23	0.80–1.10	0.40–0.60	0.08–0.15	0.20–0.40	0.20–0.40	2.53
NE 9422	0.20–0.25	0.80–1.10	0.40–0.60	0.08–0.15	0.20–0.40	0.20–0.40	2.64
NE 9430	0.28–0.33	0.90–1.20	0.40–0.60	0.08–0.15	0.20–0.40	0.20–0.40	3.28
NE 9435	0.33–0.38	0.90–1.20	0.40–0.60	0.08–0.15	0.20–0.40	0.20–0.40	3.53
NE 9437	0.35–0.40	0.90–1.20	0.40–0.60	0.08–0.15	0.20–0.40	0.20–0.40	3.65
NE 9440	0.38–0.43	0.90–1.20	0.40–0.60	0.08–0.15	0.20–0.40	0.20–0.40	3.78
NE 9442	0.40–0.45	1.00–1.30	0.40–0.60	0.08–0.15	0.20–0.40	0.20–0.40	4.19
NE 9445	0.43–0.48	1.00–1.30	0.40–0.60	0.08–0.15	0.20–0.40	0.20–0.40	4.54
NE 9450	0.48–0.53	1.20–1.50	0.40–0.60	0.08–0.15	0.20–0.40	0.20–0.40	5.15
NE 9537**	0.35–0.40	1.20–1.50	0.40–0.60	0.15–0.25	0.40–0.60	0.40–0.60	6.41
NE 9540**	0.30–0.43	1.20–1.50	0.40–0.60	0.15–0.25	0.40–0.60	0.40–0.60	6.95
NE 9542**	0.40–0.45	1.20–1.50	0.40–0.60	0.15–0.25	0.40–0.60	0.40–0.60	7.16
NE 9550**	0.48–0.53	1.20–1.50	0.40–0.60	0.15–0.25	0.40–0.60	0.40–0.60	7.75
Manganese-silicon-chromium steels							
NE 9630	0.28–0.33	1.20–1.50	0.40–0.60	.....	0.40–0.60	.....	3.12
NE 9635	0.33–0.38	1.20–1.50	0.40–0.60	.....	0.40–0.60	.....	3.36
NE 9637	0.35–0.40	1.20–1.50	0.40–0.60	.....	0.40–0.60	.....	3.46
NE 9640	0.38–0.43	1.20–1.50	0.40–0.60	.....	0.40–0.60	.....	3.58
NE 9642	0.40–0.45	1.30–1.60	0.40–0.60	.....	0.40–0.60	.....	3.95
NE 9645	0.43–0.48	1.30–1.60	0.40–0.60	.....	0.40–0.60	.....	4.06
NE 9650	0.48–0.53	1.30–1.60	0.40–0.60	.....	0.40–0.60	.....	4.27
Carbon-chromium steels							
NE 52100A	0.95–1.10	0.25–0.45	0.20–0.35	0.08 Mx.	1.30–1.60	0.08 Mx.	2.38
NE 52100B	0.95–1.10	0.25–0.45	0.20–0.35	0.08 Mx.	0.90–1.15	0.35 Mx.	2.98
NE 52100C	0.95–1.10	0.25–0.45	0.20–0.35	0.08 Mx.	0.40–0.60	0.35 Mx.	3.22

* These figures are not a part of the official specifications. They represent diameters of round bars, grain size 6, which will harden through to the center. Computations made E. E. Thum, Editor, *Metal Progress*, and based on Grossmans' methods.

** Recommended for large sections only.

FORGING AND HEAT-TREATMENT

The NE 1300 (carbon-manganese) steels are intended primarily for oil hardening. They can be quenched in water only at extreme risk, particularly when the design of the part is such that it will be susceptible to cracking.

When NE 1330 and 1335 are water-hardened for some applications, such as spline shafts, the quenching temperature should be 1,475–1,550 F., but before quenching in water it is advisable to first quench them for a few seconds in oil. Drawing temperatures between 600 and 1,200 F. are used. When drawn at 600 F. a tensile strength around 190,000 lb. per sq. in. may be expected, whereas a drawing temperature of 1,200 F. will result in a tensile strength between 85,000 and 95,000 lb. per sq. in.

When oil hardened the quenching temperature should be 1,500–1,525 F. They harden to 375–250 Brinell by drawing at 900–1,000 F.

None of 1300 series present unusual difficulties in regular forging operations, and can be used freely in parts which require forging as a preliminary to their manufacture. After forging they should be normalized at 1,600–1,700 F. and annealed at 1,500–1,600 F.

THE 8000 SERIES

The manganeses-molybdenum NE steels (NE 8029, 8022, 8339 and 8442) are easily forged and respond readily to heat-treatment. They have good deep-hardening characteristics. Ductility is high since carbon can be kept low while manganese and carbon impart strength. In general, they are used where resistance to impact and fatigue stresses is essential. Typical applications include automobile crankshafts and drive shafts, dredge buckets, rock crusher parts, railway coupling pins and rails, locomotive tires, spring hanger bolts and high-tensile studs.

NE 8020 and 8022 are carburizing grades and after normalizing should be carburized at 1,650–1,700 F. and quenched in oil. If cooled and reheated before quenching, the temperature should be 1,525–1,575 F. Relatively high tensile strength results when they are drawn at 250–350 F. When oil hardened, the quenching temperature should be 1,600–1,625 F.

NE 8339 and 8442 are oil-hardening grades. They can be forged readily at 1,950–2,100 F., but not below 1,800 F. General practice includes normalizing at 1,600–1,650 F., oil quenching from 1,550–1,650 F., and tempering at 1,000–1,250 F.

In the nickel-chromium-molybdenum steels (NE 8613 through 8949), NE 8613, 8615, 8617, 8620, 8717, 8720 and 8722 are carburizing grades. In tests made with these steels, they were carburized at 1,700 F. for eight hours. Some were oil quenched direct from the pot, machined and tested. Others were air cooled, reheated to 1,525–1,550 F., oil quenched and then drawn. A summary of the properties obtained with such treatments is given in one of the tables.

The remaining steels in this series are oil-hardening, although the medium carbon grades, NE 8630, 8735 and 8739 may be water hardened providing caution is exercised to prevent cracking. After normalizing, usually at 1,600–1,700 F., they should be annealed at 1,450–1,550 F. Required hardness may be obtained by quenching from 1,550 to 1,600 F. and drawing between 500 and 1,200 F. Similar treatment apply for the other grades. Those with 0.35 percent carbon and higher should be oil quenched. Physical characteristics of many of the NE 8000 series, following specific heat-treatments, are given in the tables.

THE 9200 SERIES

The silicon-manganese steels (NE 9255, 9260 and 9262) should be oil-hardened, although brine- or water-hardening may be used when chisels, rivet sets, and press tools are made from them. They have good deep-hardening characteristics, especially NE 9262, which contains 0.20–0.40 percent chromium. They make excellent spring steels. For large flat springs, the plates may be heated to 1,800 F. for slotting, nibbling, spear pointing and tapering. For forming, the temperature should not exceed 1,750 F. When annealing is necessary for machining, to relieve machining strains, cold-working strains, or strains from local heating, the steels may be heated to 1,250–1,325 F.

When employed for making large flat or helical springs, the NE 9200 series steels should be normalized at 1,600–1,625 F., oil-quenched from 1,575–1,600 F., and drawn at temperatures of 850–1,500 F. Hardness will be 363–429 Brinell. It is recommended that the quenching oil be circulated constantly and maintained at 100–140 F. The method of cooling after tempering is not important. After tempering in a salt bath, a hot-water dip removes the salt film from the springs.

These steels may also be used for chisels, solid shear blades, rivet sets for hot work, and press tools for shearing, blanking and punching. For these tools, the steel should be forged between 1,800–1,950 F. and during forging the temperature should not drop below 1,600 F. In bringing them to forging heat, the temperature rise should be show up to 1,450 F.

For normalizing, raise the temperature slowly to 1,450 F., and then fast to 1,600 F., which should be held for 15 to 60 min., depending on the size of the section, to permit complete heat penetration. The steel should be annealed at 1,450–1,500 F., holding the temperature for one to four hours.

When hardening chisels, an oil or water quench can be used after holding a hardening temperature of 1,650–1,750 for 10–30 min. Drawing temperatures between 500 and 600 F. are recommended. For pneumatic chisels, shank breakage may be minimized by quenching the tool all over and tempering the shank separately to a Brinell hardness of 375–430.

Press tools are usually hardened from 1,575–1,675 F., quenched in brine or water, and drawn at 350–650 F.

Rivet sets for hot work are hardened by holding a quenching temperature of 1,550–1,650 for 15 min., quenching in water and drawing at 600–800 F.

Solid shear blades may be hardened by holding a quenching temperature of 1,550–1,650 F. for 15 min. to 1 hr., quenching in brine or water, and drawing at 300–550 F.

Although these steels, when used for press tools, shear blades and chisels, are usually water-quenched to a Rockwell C hardness of 65, they can be oil-quenched to a Rockwell hardness of about 60 C. In heating, all of these steels decarburize to give a soft skin, unless special precautions are taken to avoid it, or the tool is ground after hardening. It is often best to temper below 500 F., since these steels all start to soften rapidly above 600 F.

THE 9400-9500 SERIES

The 9000 series of NE steels was established to utilize residual alloys from scrap metal. Since heats of these steels have just recently been run, little or no data are as yet available. However, heat-treatment of them should parallel those for the 8000 series.

The carburizing grades (NE 9415, 9420, 9422) can be carburized at 1,650–1,700 F., retaining the parts in the pots for 8 hr. They can be oil-quenched, rather than water-quenched.

ACTUAL APPLICATIONS OF NE STEELS

NE Steel*	Substituted for	Use
8024	4615	Worm gears
	4615	Tools
	4615	Drive gear and spindle for milling machines
	4140	Milling machine spindles
	4120	Steering gear worms
	3115	Ball studs
	4620	Machine tool shafts
8124	4120	Bull pinion and brake shaft, bevel pinion and shaft, drive level gear, and a differential pinion for tractors
8233	....**	Nuts and bolts for aircraft
8245	4140	Power take-off shaft for tractor
	4142	Power take-off shaft for tractor
8339	3045	Steering arm studs
	....**	Studs for trucks
	3135, 2340	Steering arm ball studs, connecting rod bolts, brake bolts
	4140	Dowel pins, truck gears
	....**	Seamless pipe for bombs
	3140	Side links for transmission chains. Brake adjusting bolts
	Special	Seamless tubing
8442	....**	Nuts and bolts for marine engines; worm shafts; studs for diesel engines
	....**	Sockets for building repairs and maintenance; crank shafts for high-pressure spraying equipment; chain rollers
	3135	Machine tool shafts
	4140	Armature shafts, spring clips
	4142	Tractor rear axles
	4140	Steering knuckles and starting crankshafts for tractors
	4640	Aero-propeller wrenches
	4140	Socket wrenches, die inserts, drill shanks
	6140	Wrenches
	5150	Chain pins
	Special	Locomotive side rods, piston rods, and crankpins
	4142	Low-temperature studs
	3140	Oil-well tool joints
	Special	Locomotive side rods, piston rods, crank pins
8447	3140	Steering knuckles
	4140	Lever holders
	4145	Tractor shafts and gears
	4150	Truck axles
	....**	Toolholder shanks
	3135	Steering knuckles
8547	4150	Gears
	....**	Shell and bomb parts
8620	4120	Transmission gears
	2315	Air-drill parts, machine tool gears
	4615	Chuck jaws, coal-cutting chain bushings
	3120	Roller bearing cups and cones, transmission spline shafts
	4320	Rear axle drive pinions
	6120	Differential spiders
	....**	Plunger reserve bushings for roller-type chains, bracket lock for motor vehicles, worm shafts, machine tools
	4620	Roller bearings, truck ring gears, truck rear axle pinions, differential cross truck transmission gears, transmission spline shafts, differential side gears, diesel piston pins, gun hammer forgings
	4615	Clutch gears, truck gears, trunnions for front axle drive trucks, diesel engine bolts
8620	4620, 4820	Flywheel starter gears
	6115	Differential gears (Automotive)
	4119	Differential gears (Automotive)
	3115	Gears and rolls (Automotive)
	4120	Truck gears (Automotive)
	4023	Bearing cups and cones (Automotive)
	4023	Transmission gears (Automotive)
	3115	Shafting (Automotive)
8630	2330	Aircraft bolts and turnbuckles, aircraft engine bolts and screws
	4130	Steering arms, bolts, piston rods, hand tools
	6135	Cutter bit holders and wedges
8724	4620	Bearing cones
	4820	Tractor gears
	6120	Transmission gears
	6130	Automotive: differential pinions and transmission gears; large sprocket wheels and hubs
	4820	Automotive pinion gears
	6115	Automatic and chucking machines
8739	3136, 3135, 3140	Aircraft engine bolts, bolts, diesel engine nuts
	4137	Mining machinery parts
	5140	Transmission gears
	4640	Truck transmission gears
8744	3140	Machine tool parts
	4142	U-bolts
	2345	Tractor gears and shafts
	3145	Heavy-duty setscrews
	4140	Engine bolts and studs
	4142	Spring clips
	3135	Main bearing nuts
	Special	Seamless tubing
	....**	Digging teeth for excavating machinery; shafts, pinions, axles for mining machinery
8749	3250	Tank-track pins
	3450	Heavy machine tool parts
	....**	Lifting jacks
	5152	Anti-friction roller bearings
	3250	Pin tubing and track pins for combat vehicles
	2350	Tool forgings and machine tool parts
	4640	Pneumatic tool parts
	4150	Machine tool gears
	5150	Transmission gears
8817	4320	Coal-cutting chain straps
	3115	Carburized transmission gears and machine tool parts
	2515, 2320	Machine tool gears
8949	3250	Lathe parts, track pins
	3450	Heavy machine tool parts
	3240	Axle shafts, truck clutch parts
	4340	Gas engine connecting rods
	2345	Milling machine transmission gears
	3145	Oil-well machinery parts
8815#	4620	Armature shafts
	4615	Small machine gun parts
8720	4820	Rear axle pinions, transmission gears
8740#	6150	Aircraft screws
8770#	....**	Grate bars

* Steels given in this column are those originally listed in National Emergency classification. The ones not included in the new classification can be replaced as follows:
NE 8024 by NE 8020, 8022, 9420.
NE 8124 by NE 8020, 8022, 9420, 9422.
NE 8233 by NE 8339.
NE 8245 by NE 8442.
NE 8447 by NE 1345, 9642, 9442.
NE 8547 by NE 9540.
NE 8620 by NE 8020, 8022, 9420.
NE 8630 by NE 1330, 9430, 9630.
NE 8724 by NE 8720, 9422.

** The steel number replaced by the given NE steel is not available.

These steels are not included in either the original or current National Emergency classifications; however, the base composition of each conforms to the 8700 series, excepting carbon which was modified for the specific applications noted here.

The higher carbon grades in this series should always be oil-quenched. The physical properties of those with 0.50 percent carbon and 0.15 percent molybdenum (NE 9445 and 9550) after oil-quenching and drawing will compare favorably with SAE 4150. Practice with steels of similar composition as the high-carbon NE 9400 and 9500 series includes normalizing at 1,600–1,700 F., annealing at 1,450–1,550 F., and oil-quenching from 1,500–1,600 F. Drawing temperatures range from 500 to 1,200 F., depending on the hardness desired.

These steels may be expected to give high physical properties. For example, one NE 9550 steel (carbon, 0.50 percent; manganese, 1.20 percent; chromium, 0.60 percent; nickel, 0.40 percent; molybdenum, 0.15 percent) oil-quenched from 1,525 F. and drawn at 800 F. gave the following results: tensile strength 220,000 lb. per sq. in.; yield point, 192,000 lb. per sq. in.; elongation in 2 in., 11 percent; reduction of area, 40 percent; Brinell hardness, 477. Drawn at 1,200 F., the results were: tensile strength, 152,000 lb. per sq. in.; yield point, 130,000 lb. per sq. in.; elongation, 22 percent; reduction of area, 58 percent; Brinell hardness, 311.

All the NE 9400 and 9500 series may be forged readily at 2,000–2,220 F., but during forging the temperature should not drop below 1,800 F.

THE 9600 SERIES

The manganese - silicon - chromium steels (NE 9600 series) are oil-hardening types, although NE 9630, 9635, 9637 and 9640 may be water hardened if precautions are taken to prevent cracking, especially on thin sections or those with sharp corners and fillets. High physical properties can be expected in the normalized and in the quenched and tempered conditions.

The 0.40–0.50 percent carbon grades can be used in the normalized condition. By heat-treatments involving normalizing at 1,650 F., water-quenching from 1,600 F., and tempering at 1,100–1,200 F., the 0.28–0.35 percent carbon grades give yield points from 100,000 to 120,000 lb. per sq. in.

In general, the NE 9600 series should be normalized at 1,550–1,650 F., oil-quenched from 1,500–1,600 F., and drawn between 700 and 1,250 F. for required hardness. Expected phys-

RECOMMENDED APPLICATIONS OF NE STEELS

Steel generally used	RECOMMENDED NE STEEL				APPLICATIONS
CARBURIZING GRADES:					
2317 2320*	NE 8020	NE 8022	NE 9420	.....	Automotive gears, knuckle pins, shafts and collars.
3115 3120	NE 8020	.....	NE 9420	.....	Rings gears and pinions, spline and countershafts, transmission gears, piston pins, oil-well drilling cutters and reamers, anti-friction bearings.
4023 4024♦	NE 8715	NE 8022	NE 9420	.....	Transmission gears and shafts, side gears, differential pinions, countershafts, spline shafts.
4119 4615 4620 5120 6120♦ NE 8620**	NE 8020	.....	NE 9420	.....	Ring gears, agricultural and automotive transmission differential and pinion gears; oil-well drilling cutters and reamers, anti-friction bearings; general purpose pins and shafts; free-wheeling cams; fatigue-resistant shafts; aircraft gears and pins.
4027 4032 4120♦	NE 8022	.....	NE 9422	.....	Automotive gears, spline shafts, light-truck gears, oil-well drilling cutters and reamers, anti-friction bearings, general purpose pins and shafts.
NE 8124	NE 8020	NE 8022	NE 9420	NE 9422	Bull pinions and brake shafts, bevel pinions and shafts, drive level gears and differential pinions for tractors.
4320	NE 8720	.....	NE 9422	.....	Bus and truck transmission and differential gears and pinions.
4815	NE 8715	.....	NE 9420	.....	Steering knuckle pins, roller bearings, chain pins, high-strength studs and bolts; oil-well rotary cutters; truck, bus and tractor differential gears, shafts and pinions.
4820	NE 8720	.....	NE 9422	.....	
2512♦	NE 8715	.....	NE 9415	.....	Aircraft engine crankshafts; truck, bus and tractor transmission and differential gears.
2515	NE 8720	.....	NE 9422	.....	
NE 8720**	.....	.....	NE 9420	.....	Automotive transmission and differential gears, machine tool gears, machine tool parts, splines and countershafts.
NE 8817†	NE 8720	.....	NE 9422	.....	
SEMI-THOROUGH HARDENING GRADES:					
2330 3130 4037 4042	NE 1330	.....	NE 9430	.....	Keys, heat-treated bolts, screws, studs, nuts, levers, large truck gears, steering arms.
4047	NE 1335	.....	NE 9435	NE 9635	Spindles, synchronizing rings, crankshafts, axles, splines, chain links, studs, screws, propeller shafts.
4130 5130♦ 6130 NE 8233†	NE 1330	.....	NE 9430	NE 9630	Aircraft sheets, tubing and bars for welding and heat-treatment or both; bolts and scarifier teeth, automotive side gears, aircraft propeller blades, axles, steering knuckles and arms, aircraft nuts and bolts.
THOROUGH HARDENING GRADES:					
NE 8339**	NE 1335	.....	NE 9430	NE 9630	Automotive studs, connecting rod bolts, brake bolts, steering arm ball studs, dowel pins; side links for transmission chains; seamless pipe for bombs; crankshafts, axles, splines, transmission shafts, propeller shafts, axles tubing, aircraft forgings.
NE 8630**	NE 1330	.....	NE 9430	NE 9630	Aircraft bolts and turnbuckles, aircraft engine bolts and screws, steering arms, bolts, piston rods, hand tools, cutter bit holders and wedges.
2335♦	NE 1340	.....	NE 9435	NE 9635	Aircraft engine connecting rods, connecting rod bolts, crankcase bolts, studs, keys, propeller shafts, generator shafts, pump shafts, rocker arms and gears. Machine tool gears, collets, cams, shafting, feed fingers, tool holders. Pneumatic tool barrels and pistons. Textile and printing machine rollers. Rotors and shafts for prime movers. Oil refinery low-temperature pressure vessels, pipe valves and fittings. Marine engine cam shafts and propeller shafts. Hydraulic valves. Structural eye bars, booms, tie plates and trusses.

ical properties range between 120,000 and 125,000 lb. per sq. in. tensile strength; 60,000 and 85,000 lb. per sq. in. yield strength; 20 and 30 percent elongation in 2 in.; and 40 and 60 percent reduction of area.

THE 52100 SERIES

Because of the chromium and high carbon in the NE 52100 steels they are deep hardening and develop a high degree of surface hardness. For this reason they are used extensively as races and balls or rollers of anti-friction bearings.

When the manganese is lower than 0.35 percent, these steels can be water hardened. Under all conditions of heat-treatment they show much greater dimensional changes than carbon steels of corresponding carbon content. In normalizing and annealing, temperatures about 35 F. higher are required than for straight carbon steels, and for oil-quenching the temperatures are 100 F. higher. General practice includes annealing at 1,350–1,450 F. and water-quenching from 1,425–1,475 F. or oil-quenching from 1,500–1,600 F. After hardening and tempering to about 300 F., these steels have Rockwell hardness values of 65–70 C.

To spheroidize for machining, the NE 52100 steels should be heated to 1,350–1,450 F. and cooled slowly for 10 to 40 hours.

RECOMMENDATIONS

The steel user should keep in mind the importance of obtaining the de-

RECOMMENDED APPLICATIONS OF NE STEELS

Steel generally used	RECOMMENDED NE STEEL				APPLICATIONS
3135	NE 1335	.....	NE 9435	NE 9635	Aircraft engine, bolts, nuts, studs, crankshafts. Automotive steering arm, knuckles, knuckle pins, crankshafts, differential gears, pinion shafts, ring and side gears, drive shafts, transmission gears and splines. Machine tool shafts, lead screws and spindles. Marine engine crankshafts and bolts. Bridge cantilever pins. Die blocks. Die-casting dies. Oil-well drilling equipment — bolts, couplings, shafting, drill collars, reamer bodies, pump rods, tool joints.
5135*	NE 1335	.....	NE 9435	NE 9635	Automotive leaf and coil springs, transmission gears and spline shafts. Machine tool gears. Crusher jaws. Digger bucket teeth. Hand hammers.
5140	NE 1340	.....	NE 9435	NE 9635	
6135*	NE 1335	.....	NE 9435	NE 9635	
6140*					
NE 8635†	NE 1340	.....	NE 9435	NE 9635	
NE 8735**					
4137					Aircraft: engine crankshafts, connecting rods, cylinder liners, forgings, piston pins, knuckle pins, bolts, nuts, studs, coil springs; propeller hubs and blades; structural shapes, tubing.
4640	NE 1340	.....	NE 9637	NE 9437	
NE 8739**					
3045					Automotive: differential pinions and side gears, transmission gears, spline shafts, steering arms and knuckles, connecting rods, crankshafts, rear axles, leaf and coil springs.
3140					
4140	NE 1345	.....	NE 9640	NE 9440	
4645					Marine engines, mill machinery and pneumatic machines: crankshafts, pistons, bolts, connecting roads, sprockets, spindles, winch shafts, valve springs, valve seats, shafting.
5145					
6145					Structural: eye bars, cantilever pins, chain pins.
2340					
3141					Machine tools: shafts, leadscrews, chuck jaws, spindles, toolholders, collets.
3240					
4142♦	NE 1345	.....	NE 9642	NE 9442	Hand tools: chisels, hammers, pliers, screwdrivers, wrenches.
NE 8442**					
NE 8744**					Oil-industry: high-temperature bolts, pistons, plungers, and parts of pressure vessels for refinery equipment. Bolts, couplings, shafting, drill collars, jars, kelly bars, reamer bodies, pony rods, pull rods, rotary table shafting, pump rods and tool joints for drilling equipment.
4337♦♯	.....	.....	.....	NE 9537	
4340♯					
NE 8547†♯	.....	.....	.....	NE 9540	
2345					Hydraulic machinery: pistons, plungers, shafts, rams, impellers.
3145					
4145					Miscellaneous: locomotive springs, hot-work dies, cold-heading dies, die-casting dies, valve springs, scarifier teeth, winch shafts, pneumatic tool bits, crusher jaws, bucket teeth.
5150	NE 1350	.....	NE 9645	NE 9445	
6150♦					
NE 8744**					
NE 8749**					
2350*					
3150					
3250*	.....	.....	NE 9650	NE 9450	
4150					
NE 8949**♯					
4063	.....	.....	NE 9255	.....	Automotive bolts, pinion shafts, front and rear axles, leaf and coil springs, sway bars, cylinder head studs, steering knuckles and arms. Hand tools — chisels, hammers, screwdrivers. Chain pins. Pneumatic bits. Scraper blades.
4065*	.....	.....	NE 9260	.....	
4068	.....	.....	NE 9262	.....	
52095♦	.....	.....	NE 52100C	.....	
52098♦	.....	.....	NE 52100B	.....	
52099♦					Anti-friction bearings of all kinds for the automotive, mining, farm-implement and aircraft industry.
52100	.....	.....	NE 52100A	.....	
52101♦					
52107♦					

* WD (War Department) steels used in equipment for the armed forces and not included in either SAE or AISI classification.

** Included in the current National Emergency steels, but because this steel has a higher molybdenum content that other NE steels, users may be asked to drop it in favor of the given alternate for certain applications.

† Not included in the current National Emergency steel classification.

♦ AISI steels not included in the SAE series.

♯ Recommended for large sections.

sired strength and hardness without the necessity of resorting to drastic forms of heat-treatment. Water- and brine-quenching may be considered as drastic forms when applied to carbon and simple alloy steels containing more than 0.35 percent carbon, and if improperly applied may lead to serious cracking and distortion. Frequently, drastic treatments can be avoided by control of grain size and by selecting a steel with either a slightly higher carbon content or with a little greater alloy content. Such discretion is important in the case of parts of intricate shapes and sudden changes in section.

To obtain uniform physical properties make the final quench from the lowest temperature that will develop the maximum strength coupled with maximum toughness; with thinner sections, lower temperatures are used than with thick ones.

When using the lower carbon steels, simple normalizing is often sufficient to place the steel in its best condition for machining and will lessen distortion in carburizing or hardening. In the more richly alloyed steels, combined normalizing and annealing constitutes best practice. For unimportant parts, the normalizing may be omitted entirely or annealing practiced only when the steel is otherwise difficult to machine.

The NE steels have many desirable features, one of which is their uniformity in processing. This is due to the fact that all hardening elements are shown in the analysis and are controlled.

HEAT-TREATMENT AND PROPERTIES OF NE STEELS

Steel No.	Composition	Specimen	Temperatures, F. Normalise	Annealing	Carburizing	Quenching temp., F., and medium[a]	Drawing temp. F.	Hardness, Brinell No.	Tensile strength, lb. per sq. in. Ultimate	Yield	Reduction of area, percent	Elongation in 2 in., percent
NE 1330[b]	.....	.....	1600–1700	1500–1600	.....	1525–1575 (W or O)	Note A	.....	.....	.....	.....	.....
NE 1330[b]	.....	.....	1700	.....	.....	.....	.....	.....	98,000	57,000	33	20
NE 1330[b]	.....	.....	1650	.....	.....	.....	.....	225	110,000	85,000	.....	24
NE 1330[b]	.....	.....	1650	1600	.....	.....	.....	190	90,000	70,000	.....	32
NE 1330[b]	.....	.....	1650	.....	.....	1600 (W)	600	.....	190,000	165,000	.....	12
							800	.....	170,000	153,000	.....	15
							1000	.....	140,000	135,000	.....	20
							1200	.....	120,000	115,000	.....	25
NE 1335[b]	.....	.....	1600–1700	1500–1600	.....	1475–1550 (W or O)	Note A	.....	.....	.....	.....	.....
NE 1335[b]	.....	.....	1650	.....	.....	.....	1250	.....	83,000–96,000	50,000–55,000	50–55	24–32
NE 1340[b]	.....	.....	1600–1700	1500–1600	.....	1500–1575 (O)	Note A	.....	.....	.....	.....	.....
NE 1345[b]	.....	.....	1600–1700	1500–1600	.....	1500–1575 (O)	Note A	.....	.....	.....	.....	.....
NE 8020	C-0.20, Mn-1.30, Si-0.15, Mo-0.30 (Note B)	.....	Note C	Note C	.....	1625 (O)	1200	.....	91,000–112,000	72,000–99,000	.....	23–27
NE 8020	.....	.....	1600–1700	.....	1650–1700	.....	.....	.....	.....	.....	.....	.....
NE 8020	C-0.23, Mn-1.00, Mo-0.16	1″ rd.	.....	.....	1700 (8 hr.—reheat to 1550) (O)		320 (2 hr.)	.....	140,000	82,000	49	18
NE 8022	.....	.....	1600–1700	.....	1650–1700	.....	.....	.....	.....	.....	.....	.....
NE 8339	C-0.35, Mn-1.40, Si-0.21, Mo-0.21	Note D	1600	1450–1550	.....	1550 (O)	1000–1200	.....	108,000–158,000	85,000–146,000	.....	15–26
NE 8339	C-0.33, Mn-1.40, Si-0.22, Mo-0.21	2″ sq.	1600	1450–1550	.....	1550 (O)	1000–1200	.....	114,000–124,000	93,000–102,000	59–62	22–25
		4″ sq.	1600	1450–1550	.....	1550 (O)	1000–1200	.....	108,000–115,000	85,500–90,500	44–47	18–21
NE 8339	.....	1¼″ rd.	1600	.....	.....	1550 (W)	1130	269	132,200	121,000	63	22
		1¼″ rd.	1600	.....	.....	1550 (O)	1130	269	120,200	95,100	66	23
NE 8339	C-0.43, Mn-1.61, Si-0.29, Mo-0.25	2″ rd.	.....	.....	.....	1565 (O)	950	311	160,000	140,000	49	16
		2″ rd.	.....	.....	.....	1565 (O)	1250	235	110,000	90,000	64	25
NE 8442	.....	1⅜″ rd.	.....	.....	.....	1550 (O)	1075	311	156,000	146,000	56	18
						1550 (O)	1125	290	144,000	129,000	61	20
		1¼″ rd.	1600	.....	.....	1550 (W)	1130	293	142,400	136,850	58	21
						1550 (O)	1130	285	143,500	131,650	60	21
		4½″ sq.	.....	.....	.....	1550 (O)	1225 (5 hr.)	241	113,000	88,000	63	21
NE 8442	C-0.38, Mn-1.59, Mo-0.37	Note E	.....	.....	.....	1550 (O)	1100	.....	113,000–121,000	79,000–94,000	40–52	18–20
							1240	.....	93,000–97,000	69,000–71,000	56–64	24–26
NE 8442	C-0.38, Mn-1.59, Mo-0.37	Note F	.....	.....	.....	1550 (O)	1100	.....	116,000–124,000	88,000–95,000	43–48	17–20
							1240	.....	96,000–100,000	68,500–75,500	57–64	23–26
NE 8442	C-0.40, Mn-1.50, Mo-0.35	Note G	.....	.....	.....	1550 (O)	1050	.....	134,200	102,850	53	19
							1150	.....	119,900	90,200	63	23
							1250	.....	107,250	84,700	66	26
NE 8442	C-0.45, Mn-1.34, Si-0.30, Mo-0.30	Note H	1600	1450–1500	.....	1550 (O)	1000	.....	135,000–142,000	105,000–110,000	.....	10–16
NE 8442	C-0.45, Mn-1.58, Si-0.26, Mo-0.32	1″ rd.	.....	.....	.....	1580 (O)	1100	321	155,000	140,000	54	20
		2″ rd.	.....	.....	.....	1580 (O)	1100	311	145,000	130,000	55	20
		4″ rd.	.....	.....	.....	1580 (O)	1100	302	128,000	92,000	56	20
NE 8615	C-0.18, Mn-0.83, Cr-0.53, Ni-0.55, Mo-0.28	½″ rd.	.....	.....	1700 (8 hr.—reheat to 1600) (O)		320 (2 hr.)	.....	188,000	125,000	55	15
		1″ rd.	.....	.....	1700 (8 hr.—reheat to 1600) (O)		320 (2 hr.)	.....	142,000	90,000	53	20
NE 8617	C-0.19, Mn-0.86, Si-0.29, Cr-0.49, Ni-0.48, Mo-0.35	½″ rd.	1650	.....	1700 (8 hr.—reheat to 1550) (A)		300 (¾ hr.)	363–375	185,000–165,000	165,000–142,000	38–48	12–13
		1″ rd.	1650	.....	1700 (8 hr.—reheat to 1550) (A)		300 (1¼ hr.)	352–341	150,000–139,000	130,000–118,000	42–48	15–19
NE 8620	C-0.23, Mn-0.90, Si-0.32, Cr-0.50, Ni-0.51, Mo-0.25	1″ rd.	1750	.....	.....	1550 (O)	500	330	180,000	145,000	53	11
							900	281	130,000	110,000	63	19
							1200	223	100,000	95,000	69	25
NE 8620	C-0.19, Mn-0.80, Si-0.23, Cr-0.52, Ni-0.46, Mo-0.22	½″ rd.	1650	.....	1700 (8 hr.) (Direct in oil)		300 (¾ hr.)	388	155,000	135,000	38	12
		1″ rd.	1650	.....	1700 (8 hr.) (Direct in oil)		300 (1¼ hr.)	363	135,000	110,000	40	16
		½″ rd.	1650	.....	1700 (8 hr.—reheat to 1525) (A)		300 (¾ hr.)	363	140,000	118,000	45	16
		1″ rd.	1650	.....	1700 (8 hr.—reheat to 1525) (A)		300 (1¼ hr.)	293	126,000	106,000	48	19
NE 8630	C-0.33, Mn-0.79, Si-0.22, Cr-0.40, Ni-0.45, Mo-0.15	1″ sq.	1700	.....	.....	1540 (O)	1000	340	142,000	127,000	54	17
							1100	302	133,900	118,000	63	20
							1200	269	115,400	98,900	65	23
							1300	223	104,400	83,450	70	27
NE 8630	C-0.33, Mn-0.88, Si-0.31, Cr-0.51, Ni-0.54, Mo-0.22	1″ rd.	1700	.....	.....	1525 (O)	500	430	240,000	205,000	45	10
							900	311	160,000	150,000	59	18
							1175	240	120,000	110,000	65	22
NE 8630	C-0.26, Mn-0.78, Si-0.30, Cr-0.47, Ni-0.56, Mo-0.20	1″ rd.	.....	.....	.....	1550 (W)	600 (1 hr.)	396	199,000	163,000	48	12
							800 (1 hr.)	344	170,000	153,000	58	15
							1000 (1 hr.)	302	142,000	128,000	63	18
							1200 (1 hr.)	240	118,000	99,000	70	25
NE 8630	C-0.30, Mn-0.80, Si-0.25, Cr-0.49, Ni-0.42, Mo-0.22	3″ rd.	1650	.....	.....	1550 (O)	900 (4 hr.)	241	118,000	95,000	55	19
							1000 (4 hr.)	235	115,000	93,000	56	20
							1100 (4 hr.)	217	111,000	98,000	62	22
		5″ rd.	1650	.....	.....	1550 (O)	900 (4 hr.)	241	115,000	88,000	55	19
							1000 (4 hr.)	228	112,000	85,000	57	20
							1100 (4 hr.)	196	100,000	79,000	59	22
NE 8739	C-0.41, Mn-0.86, Si-0.31, Cr-0.47, Ni-0.46, Mo-0.26	½″ rd	1650	.....	.....	1525 (O)	500 (¾ hr.)	514	260,000	245,000	33	10
							800 (¾ hr.)	444	200,000	180,000	50	14
							1100 (¾ hr.)	311	175,000	140,000	56	18
		1″ rd.	1650	.....	.....	1525 (O)	500 (1¼ hr.)	514	250,000	235,000	35	9
							800 (1¼ hr.)	415	200,000	180,000	45	10
							1100 (1¼ hr.)	321	150,000	130,000	56	15
		3″ rd.	1650	.....	.....	1525 (O)	900 (3¾ hr.)	340	140,000	120,000	55	16
							1000 (3¾ hr.)	321	135,000	118,000	60	18
							1100 (3¾ hr.)	286	125,000	119,000	63	20
		5″ rd.	1650	.....	.....	1525 (O)	900 (4 hr.)	321	132,000	117,000	52	16
							1000 (4 hr.)	286	125,000	113,000	56	17
							1100 (4 hr.)	255	119,000	99,000	58	20
NE 8739	C-0.37, Mn-0.91, Si-0.30, Cr-0.51, Ni-0.54, Mo-0.25	1″ rd.	1650	.....	.....	1500 (O)	500	450	255,000	230,000	52	11
							900	357	175,000	165,000	56	15
							1175	269	130,000	118,000	66	22
NE 8744	C-0.44, Mn-0.89, Si-0.27, Cr-0.50, Ni-0.58, Mo-0.25	1″ rd.	1650	.....	.....	1500 (O)	500	490	275,000	245,000	44	11
							900	338	190,000	180,000	59	15
							1175	273	135,000	130,000	55	21
NE 8744	C-0.42, Mn-0.99, Si-0.26, Cr-0.46, Ni-0.56, Mo-0.26	1″ rd.	1650	.....	.....	1550 (O)	950	363	178,000	160,000	52	15
							1000	311	150,000	135,000	58	19
							1250	255	123,000	114,000	62	22
		2″ rd.	1650	.....	.....	1550 (O)	950	321	155,000	130,000	54	19
							1000	277	135,000	115,000	60	21
							1250	229	116,000	84,000	65	26

HEAT-TREATMENT AND PROPERTIES OF NE STEELS

Steel No.	Composition	Specimen	Temperatures, F. Normalize	Annealing	Carburizing	Quenching temp., F., and medium [a]	Drawing temp. F.	Hardness, Brinell No.	Tensile strength, lb. per sq. in. Ultimate	Yield	Reduction of area, percent	Elongation in 2 in., percent
NE 8749	C-0.45, Mn-0.90, Si-0.28, Cr-0.50, Ni-0.50, Mo-0.25	½-1¼" rd.	.....	.....	.....	1500 (O)	700	444	225,000	200,000	37	10
							1000	356	170,000	160,000	50	15
							1300	255	115,000	105,000	65	24
NE 8749	C-0.50, Mn-1.15, Si-0.28, Cr-0.56, Ni-0.50, Mo-0.25	½-1¼" rd.	.....	.....	.....	1500 (O)	700	477	250,000	225,000	32	9
							1000	387	192,000	180,000	51	15
							1300	241	118,000	110,000	62	23
NE 8749	C-0.53, Mn-0.36, Si-0.28, Cr-0.44, Ni-0.43, Mo-0.20	½" rd.	1700	.....	.....	1500 (O)	1050	364	167,750	142,950	41	15
							1150	311	150,250	125,450	47	17
							1250	255	120,300	102,000	57	24
							1300	244	113,550	92,350	57	24
NE 8749	C-0.55, Mn-0.83, Si-0.23, Cr-0.52, Ni-0.46, Mo-0.27	½" rd.	1650	.....	.....	1500 (O)	900 (3¾ hr.)	415	200,000	180,000	42	10
							1000 (3¾ hr.)	363	168,000	143,000	49	15
							1200 (3¾ hr.)	332	143,000	123,000	52	19
		1" rd.	1650	.....	.....	1500 (O)	800 (1¾ hr.)	444	230,000	205,000	38	10
							1000 (1¾ hr.)	387	190,000	165,000	43	13
							1200 (1¾ hr.)	311	143,000	120,000	52	18
		3" rd.	1650	.....	.....	1500 (O)	900 (3¾ hr.)	415	190,000	170,000	40	11
							1100 (3¾ hr.)	387	175,000	155,000	48	14
							1200 (3¾ hr.)	332	150,000	130,000	56	16
		4" rd.	1650	.....	.....	1500 (O)	900 (4 hr.)	415	175,000	155,000	45	12
							1100 (4 hr.)	387	165,000	140,000	50	15
							1200 (4 hr.)	440	150,000	125,000	53	16
NE 8949	C-0.49, Mn-1.10, Si-0.27, Cr-0.51, Ni-0.52, Mo-0.38	½" rd.	1650	.....	.....	1500 (O)	800 (¾ hr.)	461	230,000	210,000	45	11
							1000 (¾ hr.)	401	190,000	170,000	50	15
							1200 (¾ hr.)	293	142,000	123,000	60	20
		1" rd.	1650	.....	.....	1500 (O)	800 (1¼ hr.)	477	235,000	210,000	41	10
							1000 (1¼ hr.)	415	193,000	170,000	48	14
							1200 (1¼ hr.)	321	151,000	130,000	56	18
		3" rd.	1650	.....	.....	1500 (O)	900 (3¾ hr.)	429	205,000	183,000	40	10
							1100 (3¾ hr.)	387	185,000	170,000	46	12
							1200 (3¾ hr.)	363	160,000	144,000	52	15
		5" rd.	1650	.....	.....	1500 (O)	900 (4 hr.)	401	190,000	171,000	29	9
							1100 (4 hr.)	375	180,000	162,000	38	12
							1200 (4 hr.)	331	170,000	141,000	48	15
NE 9255 and 9260	C-0.60, Mn-0.75, Si-2.00.....	Note I	.....	.....	.....	1600 (O)	500–1000	375–418	180,000–205,000	140,000–190,000	.....	8–10

[a] Quenching media — W = water, O = oil, A = air.

[b] The NE 1300 series is the SAE and AISI 1300 grades and was added to the National Emergency steels at the request of the War Production Board.

NOTES:

A — Temper to required hardness.

B — For high fatigue and impact.

C — Normalized and followed with low-temperature anneal and slow cooling.

D — For railroad car couplings and locomotive tires.

E — For locomotive axles 14½ in. outside diameter and 4 in. bore.

F — For locomotive crank pins 12 in. outside diameter and 3 in. bore.

G — For locomotive side rods made up as 4½ in. round stock.

H — For locomotive tires.

I — For heavy coil and leaf springs. NE 9262 includes 0.20–0.40 chromium to improve through hardening characteristics.

TYPICAL APPLICATIONS AND HEAT-TREATMENT

Part	Steel	Forging temp., F.	Normalize temp., F.	Annealing temp., F.	Hardening temp., and quench media	Drawing temp., F.	Hardness Brinell	Hardness Rockwell C
Chisels.....	NE 9255, 9260, 9262	1800–1900[a]	1600[b]	1450–1500[c]	1650–1750(W,O)	500– 600	.....	60–65
Press tools:								
Shear, punch, blank.	NE 9255, 9260, 9262	1800–1900[a]	1600[b]	1450–1500[c]	1650–1750(B,W)	350– 700	.....	65
Railroad:								
Car couplings.....	NE 8339	.....	1600	1400–1500	1475–1550(O)	1000–1200	300–250	.....
Locomotive tires....	NE 8339, 8442	.....	1600	1400–1500	1475–1550(O)	1000–1200	300–250	.....
Rivet sets (hot work).	NE 9255, 9260, 9262	1800–1950[a]	1600[b]	1450–1500[c]	1550–1650(W,O)	600– 800	.....	60–65
Shear blades (solid)...	NE 9255, 9260, 9262	1800–1950[a]	1600[b]	1450–1500[c]	1550–1650(B,W,O)	350– 550	.....	60–65
Springs:								
Large (flat, helical).	NE 9255, 9250, 9262	.....	1600–1625[d]	.....	1575–1600(O)	650–1050	360–430	.....
Small (flat, helical).	NE 8442	.....	1600–1625	.....	1450–1525(O)	600– 850	.....	35–40
					Cold-rolled	450– 600[e]	.....	.....
					Pretempered	450– 600[e]	.....	.....
Splines.....	NE 1335	.....	1600	1400–1500	1475–1525(W)	700–1200	.....	.....
	NE 1335	.....	1600	1450–1500	1500–1525(O)	900–1000	255–217	.....
	NE 1340	.....	1600	1450–1500	1500–1625(O)	900–1000	321–255	.....
Gears.....	9445, 9450, 9437	2000–2200	1600–1750	1550–1600	1500–1550(O)[f]	450– 500	.....	.....
For applications of the following NE steels, refer to the table of recommended uses:								
NE 9420, 9422, 8715, 8720, 8722....		2000–2200	1600–1700	1525–1575	1550–1600(W)	400–1200	Note A	
NE 8735, 8739, 9430, 9435, 9437...		2000–2200	1600–1700	1525–1575	1575–1625(O)	400–1200	.....	.....
NE 9550.....		2000–2200	1650	.....	1550–1575(O)	400–1200	560–300	.....
NE 8339, 8442.....		1950–2100	1600–1650	.....	1600–1650(O)	1000–1200	320–260	.....
NE 52100 grades.....		1950–2100	1600–1650	1350–1450	1425–1475(W)	To desired hardness		
					1500–1600(O)	To desired hardness		
NE 9415, 9420.....		.....	1600–1650	(Carburize at 1650–1700 for 8 hr.)		400–1250	.....	.....

[a] Do not forge below 1,500 F. lower than this temperature.

[b] Heat slowly and hold at heat for 15 to 60 min.

[c] Anneal slowly and uniformly — cooling rate should be 50 F. max. per hour down to 1,000 F.

[d] Also used for forming temperatures.

[e] Oil tempered and cold-rolled flat and helical springs are usually given a short tempering anneal to relieve forming strains.

[f] If quenched from liquid heating media, the temperature may be dropped 20 F.

NOTE A — Use only for medium-size sections. A 3 ½-in. section water quenched from 1,575 F. and drawn at 1,040 and 900 F. gave the following properties, respectively: 106,000 and 116,000 lb. per sq. in. tensile strength, 62 and 58 percent reduction of area, and 235 and 269 Brinell hardness.

MACHINING NE STEELS

In turning the National Emergency steels in the annealed or normalized state with high-speed steel tools, surface speeds run from 48 to 130 ft. per min. for light cuts, the higher speeds being used for fine feeds. With heavy cuts, surface speeds will run from 25 to 50 ft. per min. Single-point tools should have side-rake angles of 16–20 deg., back-rake angles of 3 to 5 deg., side cutting-edge angles of 10 deg., and end and side relief angles of 3 to 6 deg.

In machining these steels with cemented-carbide tools, the same tool angles should be employed as are used on the SAE steels. For cuts of ¼ in. deep or greater, a side-rake angle of 4 deg. is recommended. For cuts lighter than this, the side-rake angle of 8 deg. can be used. A back-rake of 0 deg. is usually satisfactory for most jobs. These values of side rake and back rake angles are based upon the use of an ordinary single point tool in a lathe. Tools of other types or tools held in such a manner that the relation of the tool to the work is changed considerably from this standard turning tool set-up should have the angles changed to correspond. For example, on a plunge cut, such as involved in a grooving operation, a back-rake of between 4 and 8 deg. and a side rake of 0 deg. are recommended. Side and end relief angles of 7 deg. are satisfactory for turning these steels, although these angles may vary from 5 to 10 deg., depending on the nature of the cut being taken.

For interrupted cuts on lathes or planners, it is desirable to use a tool with a negative back rake as great as 8 deg. in combination with 10 deg. or more side rake.

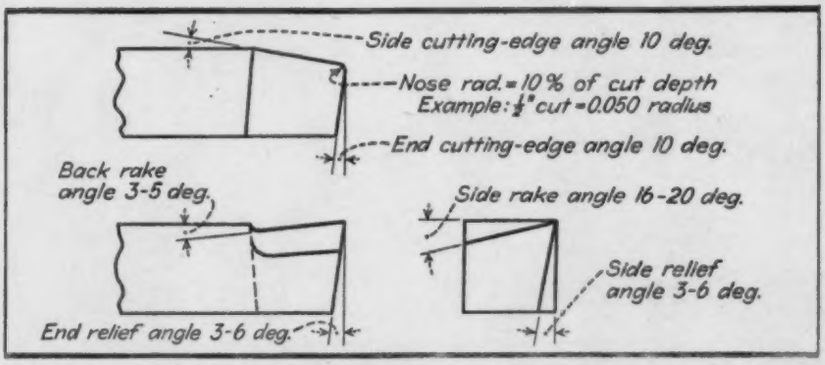
When machining with cemented-carbide tools, soluble-oil coolants are recommended.

MILLING

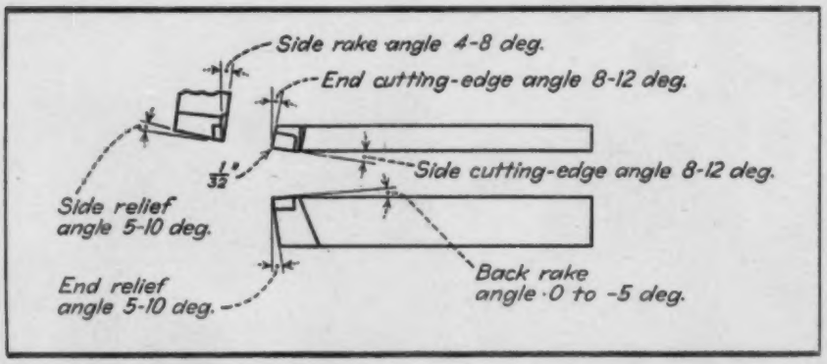
In general, milling speeds are selected to give the best compromise between maximum production and maximum life of the cutter. Cutting speeds of 60–70 surface ft. per min. and feeds of 0.008–0.010 in. per tooth are recommended for National Emergency steels, the higher speeds and feeds being used for the low carbon grades. The finish cutting speeds are often 40 to 80 percent higher than roughing speeds.

Recommended tooth angles are as follows: end relief angle, 3–5 deg.; clearance angle, 10–15 deg.; rake angles, 10–15 deg. The land end usually is $\frac{1}{32}$ or $\frac{1}{16}$ in. wide. Clearance behind the cutting edge must be sufficient to avoid rubbing, but should not be so great as to allow the cutter to "hog in."

Milling of NE steels, especially in the harder state, is done with cemented-carbide tipped-face mills. Stagger-tooth cutters, with special angles, frequently permit table speeds six to twelve times those possible with high-speed steel cutters. Surfaces produced are often accurate and smooth enough to dispense with subsequent grinding.


Side cutting-edge angle 10 deg.
Nose rad. = 10% of cut depth
Example: ½" cut = 0.050 radius
End cutting-edge angle 10 deg.
Back rake angle 3-5 deg.
Side rake angle 16-20 deg.
Side relief angle 3-6 deg.
End relief angle 3-6 deg.

NE Steels of the 8000, 9400, 9500 and 9600 series have better machining characteristics than the SAE and AISI high alloy steels which they are replacing. Shown here are recommended angles for high-speed steel cutting tools


Side rake angle 4-8 deg.
End cutting-edge angle 8-12 deg.
1/32"
Side cutting-edge angle 8-12 deg.
Side relief angle 5-10 deg.
End relief angle 5-10 deg.
Back rake angle 0 to -5 deg.

These are the recommended angles for cemented-carbide cutting tools for regular turning operations. For plunge cuts, the back rake should be between 4 and 8 degrees and the side rake 0 degrees

BROACHING

The National Emergency steels can be broached readily, provided they have been properly forged, annealed or normalized to produce correct machinability. As a rule, parts intended for broaching should be forged at a temperature higher than that usually used, and one that must remain uniform within 100 F. Machinability for broaching is improved by repeated hammering or compressing the metal during forging. They may be broached with the same broachers used for other alloy steels.

The shear angle should be from 5 to 20 deg. on shear-cut teeth. On broaches with straight teeth, the back rake angle should be from 5 to 15 deg., while the relief angle on roughing teeth should be 2 deg., and ½–1 deg. for finishing teeth. No land is recommended for the roughing teeth, but the land for the finishing teeth should be 0.010 to 0.030 in.

For internal broaching of spline holes, where broaches have sufficient strength, a cut per tooth of 0.004 to 0.005 in. on the diameter is recommended. For surface broaching, the cuts vary from 0.0025 to 0.0035 in. per tooth depending on the length, shape and size of the part.

A coolant is more beneficial during the broaching operation than a lubricant. Cutting oils have a tendency to

SPEEDS AND FEEDS FOR NATIONAL EMERGENCY STEELS

	Depth of cut, in.	High-speed steel				Stellite-type tools*				Cemented carbides	
		Feeds, in. per revolution									
		1/32	1/16	1/8	1/4	1/32	1/16	1/8	1/4	1/32	1/16
Group 1	1/32	100–161	86–138	70–113	60–97	153–346	132–212	114–184	100–161	391–630	357–575
	1/16	91–147	80–130	67–108	57–92	140–225	122–195	106–170	93–150	371–597	329–530
	1/8	81–131	71–115	61– 91	51–83	126–201	110–177	94–152	84–136	341–552	300–530
	1/4	67–108	60– 96	51– 83	43–69	106–170	93–150	78–117	69–110	314–505	266–428
	1/2	47– 76	43– 69	39– 62	31–51	77–124	69–110	59– 94	50– 80	226–363	214–345
Group 2	1/32	86– 93	74– 80	60– 65	52–56	132–142	113–122	98–106	86– 93	337–364	307–332
	1/16	79– 85	69– 74	58– 62	49–53	120–130	105–113	91– 98	80– 86	319–345	283–306
	1/8	70– 76	61– 66	53– 57	44–48	108–117	95–102	81– 88	72– 78	295–319	258–279
	1/4	58– 62	52– 56	44– 48	37–40	91– 98	80– 86	68– 73	59– 64	270–292	228–247
	1/2	41– 44	37– 40	34– 36	27–29	66– 72	59– 64	50– 54	43– 46	194–210	185–200
Group 3	1/32	82– 96	70– 82	57– 67	49–57	125–146	108–126	94–110	82– 96	320–375	292–343
	1/16	75– 88	65– 77	55– 64	47–55	115–134	100–116	87–101	76– 89	304–356	269–315
	1/8	67– 78	58– 68	50– 59	42–49	103–120	90–105	77– 90	69– 80	281–328	246–288
	1/4	55– 64	49– 57	42– 49	35–41	86–101	76– 89	64– 75	56– 66	257–301	217–255
	1/2	39– 45	35– 41	32– 37	26–30	63– 74	56– 66	48– 56	41– 54	185–216	175–205
Group 4	1/32	73– 82	63– 70	51– 57	44–49	112–125	96–108	84– 94	73– 82	288–320	262–292
	1/16	67– 75	59– 65	49– 55	42–47	103–115	89–100	78– 87	68– 76	273–304	241–269
	1/8	60– 67	52– 58	45– 50	38–42	92–103	81– 90	69– 77	62– 69	252–281	220–246
	1/4	49– 55	44– 49	38– 42	32–35	78– 86	68– 76	58– 64	50– 56	231–257	195–217
	1/2	35– 39	31– 35	28– 32	23–26	57– 63	50– 56	43– 48	37– 41	166–185	157–175

Group 1 — NE 9415, 9420, 9422. NE 8000 grades, excepting 8339, 8442, 8630, 8735, 8739, 8749.
Group 2 — NE 1300 grades. NE 8339, 8442, 8630, 8735, 8739, 8749.
Group 3 — NE 9400 grades, excepting 9415, 9420 and 9422 which appear in Group 1. NE 9500 and 9600 grades. NE 8949.
Group 4 — NE 9200 and 52100 grades.
* With "2400" stellite-type tools, these speeds can be increased 25–30 percent.

NOTES:
These speeds and feeds are for turning operations on normalized and/or annealed steels.
Data are for continuous cutting with sulphur-base cutting fluid. For continuous cuts without lubricant, decrease these speeds 25 percent. For intermittent cuts with cutting fluid, decrease the speeds 15 percent. For intermittent cuts without cutting fluid, decrease the speeds 40 percent. For light finishing cuts and fine feeds, cutting speeds may be increased 50 to 100 percent.

hold heat and, due to the friction caused by broaching, broach or broaches become overheated, causing expansion and increased sizes. However, this condition will not occur if a sufficiently large volume of soluble oil is used.

DRILLING

In drilling the National Emergency steels, their Brinell hardness can be considered as a measure of their machinability. Regular high-speed drills, operated at peripheral speeds of 65–90 ft. per min. are satisfactory for Brinell hardnesses up to 200. Point angles of 118 deg., and lip clearance angles of 10 deg. are recommended. For steels of 250 Brinell, better results are obtained with drills having point angles of 130–140 deg., and lesser lip clearance angles, as low as 5 deg. in some cases.

For a hardness of 300 Brinell, a peripheral speed of 40 ft. per min. and a point angle of 130 deg. are recommended. With the steels at a hardness of 350 Brinell, drills with a point angle of 130–150 deg., operating at 20 ft. per min., are recommended. When Brinell hardness runs 400 and higher, the drills should be ground with a 150 deg. point angle, and run at a peripheral speed of 15 ft. per min.; these drills should have a heavy web, thinned at the point and designed with a slower helix angle. For steels of 350–400 Brinell hardness, cobalt high-speed drills are preferred.

When the depth of the hole is equal to four or five times the diameter of the drill or more, oil-hole drills should be used. This applies to drills $\frac{3}{8}$ in. and larger.

TAPPING AND THREADING

The carbon-manganese (NE 1300 series) and manganese-molybdenum (NE 8020, 8022, 8339 and 8442) steels are tapped better when the cutting edge of the tap has 10–15 deg. rake. The remaining NE steels, especially those containing nickel and chromium, may be tapped with excellent results when the cutting face of the tap has a hook up to 10–15 deg. Recommended peripheral speeds for high speed taps in all the NE steels are 20–35 ft. per min., with the lower cutting speeds advisable for all steels except the carbon-manganese and manganese-molybdenum grades.

A 15-deg. throat angle is recommended on chasers for threading the NE 8600, 8700, 8900, 9400, 9500 and 9600 series, since the chips can be thinned out, thereby permitting higher cutting speeds and a better finish. For

SUGGESTED WHEELS FOR GRINDING NE STEELS

Operation	Abrasive type	Abrasive grit size	Abrasive grade	Bond	Speed, surface ft. per min.
Annealed steels:					
Cylindrical	Alum. ox.	46	Medium	Vitrified	5500–6500
Centerless	Alum. ox.	46	Medium	Vitrified	5500–6500
Surface:					
Straight wheels	Alum. ox.	36–46	Soft	Vitrified	4500–5000
Cups or cylinders	Alum. ox.	24–30	Soft	Vitrified	4500–5000
Internal	Alum. ox.	46	Medium	Vitrified	5000–6000
Cutting off:					
Dry	Alum. ox.	24	Hard	Resinoid	12000–16000
Wet	Alum. ox.	46	Very hard	Rubber	9000–12000
Hardened steels:					
Cylindrical	Alum. ox.	50–60	Medium	Vitrified	5500–6500
Centerless	Alum. ox.	60	Medium	Vitrified	5500–6500
Surface:					
Straight wheels	Alum. ox.	36–46	Soft	Vitrified	4500–5000
Cups or cylinders	Alum. ox.	30–46	Very soft	Vitrified	4500–5000
Internal	Alum. ox.	60	Soft	Vitrified	5000–6000
Cutting off:					
Dry	Alum. ox.	46	Hard	Resinoid	12000–16000
Wet	Alum. ox.	46	Medium	Rubber	9000–12000

National Fine Threads of good commercial finish, threading speeds of 22–25 ft. per min. are recommended. For National Coarse Threads the speed should be 18–20 ft. per min.

A 15-deg. throat angle on the chasers permits distributing the cutting edge over 2½ imperfect threads. With this distribution of the cut, the chasers can be made much harder (nitrided) than if throat angles of 20, 30 and 45 deg. are used. Likewise, the rake angles can be decreased without affecting the finish, whereas on short throats that only take in 1 to 1½ imperfect threads and excessively high rake angles must be used to produce a passable finish. High rake angles naturally weaken the cutting edge, resulting in chipped chasers.

On all of the NE steels it is good practice to start with a rake angle of 22 deg. on the chasers and if the finish is not satisfactory the rake angle can be increased to approximately 28 deg. Should any chipping occur at the cutting edge of the chaser, the rake angle should be decreased and cutting speeds reduced to maintain the required finish on the work.

SAWING

In sawing the National Emergency steels, a hard-tooth flexible-back metal-cutting bandsaw with a raker set (one tooth to the left, one tooth straight and one tooth to the right, etc.) gives a smooth finish and satisfactory saw life. The hardness of the tooth should not bridge across the gullet. This will cause minute cracks to form in the gullet due to the constant flexing of the band, in which case high tooth load necessary with cutting the thicker sections of the steels will cause premature failure of the saw. Life expectancy of such saws is 600–1,000 sq. in. of material cut. Recommendations for the use of these saws are listed above.

Machine hacksaw blades for use on these steels should be of a high-speed steel type with 4, 6 and 10 teeth per in., for operation at 90 strokes per min. Feeds vary from 0.008 to 0.020 in. per stroke, depending upon the size of the blade being used.

GRINDING

All the National Emergency steels can be ground with the same abrasive wheels that are used for grinding comparable SAE steels, provided the hardness is the same.

Likewise, the same grinding position, including wheel and work feed, depth of cut and type of grinding lubricants, should be employed for grinding the NE steels as for the SAE steels which they have replaced. Grinding wheel recommendations for the NE steels are tabulated here.

CUTTING OILS FOR NE STEELS*

	Group 1	Group 2	Group 3
Boring, turning...	20–25W + 1SO M + (10–15) L SM–SML (2–4) LM	15–20W + 1SO M + (10–15) L SM–SML (1–4) LM	5–10W + 1SO M + (10–20) L SM–SML (3–4) LM
Broaching.....	10–20W + 1SO SM–SML (1–3) M + (10–15) L LM	10–15W + 1SO SM–SML (2–4) M + (10–20) L LM	5–10W + 1SO SM–SML (3–4) M + (10–20) L LM
Drilling.....	15–25W + 1SO SM–SML (1–3) M + (5–15) L LM	10–20W + 1SO SM–SML (2–4) M + (10–20) L LM	..... SM–SML (3–4) M + (10–20) L LM
Reaming.....	10–20W + 1SO SM–SML (1–3) M + (10–15) L LM	10–15W + 1SO SM–SML (2–4) M + (10–20) L LM	5–10W + 1SO SM–SML (3–4) M + (10–20) L .....
Honing.....	K or WSK	K or WSK	K or WSK
Lapping.....	Sperm oil Note A	Sperm oil Note A	Sperm oil Note A
Grinding.....	40–60W + 1SO (F) AS	40–60W + 1SO (F) AS	50–75W + 1SO (F) AS
Milling, hobbing..	15–25W + 1SO SM–SML (1–3) M + (5–15) L LM	10–20W + 1SO SM–SML (2–4) M + (10–20) L LM	..... SM–SML (3–4) M + (10–20) L LM
Die threading, tapping.....	M + (10–20) L SM–SML (2–3)	M + (10–20) L SM–SML (3–4)	M + (10–25) L SM–SML (4)

Group 1 — NE 8000 grades, except 8339, 8442, 8630, 8735, 8739, 8744, 8749, 8949. NE 9415, 9420, 9422.
Group 2 — NE 1300 grades. NE 8339, 8442, 8630, 8735, 8739, 8744, 8749.
Group 3 — NE 8949 and NE 9500, 9600, 9200, 52100, and 9400 grades except those in the latter grade which are in Group 1.
Legend:
W = Water.
SO = Soluble oil.
SO(F) = Soluble oil processed to free itself of grit and dirt.
SM = Sulphurized mineral oil; numbers in parenthesis indicate cutting strength, number (4) being the strongest.
LM = Straight mineral oil.
AS = Aqueous alkali solution.
L = Lard oil.
SML = Sulphurized mineral lard oil, or sulphur-base mineral lard oil.
WSK = Water-soluble kerosene.
M + (10–20)L = Mineral oil + 10 to 20 parts lard oil.
20W + 1SO = 20 parts water + 1 part soluble oil.
* A careful analysis of each specific job must be made before cutting fluid specifications can be established. If shop records do not indicate the proper fluid, consult the suppliers of cutting fluid.
Note A — Oil-base suspension compounds, which are abrasive carriers, are available from some cutting fluid suppliers. Although sperm oil is recommended for lapping, it is difficult to secure under existing world conditions.

BAND-SAW RECOMMENDATIONS

Metal thickness, in.	Saw pitch*	Saw speed, ft. per min.	Feeding pressure
Under 1/8	24–32	225	Light**
1/8–1/2	24–14	200	Light
1/2–1	14– 8	175	Light-medium
1–2½	8	150	Medium
Over 2½	6	150	Medium-heavy

* Teeth per inch. ** Hand feed.

FEEDS AND SPEEDS FOR DRILLING NE STEELS

Size, in.	Drilling feed, in. per revolution, in steels of the following Brinell		
	170–200	240–300	350–400
1/8	0.0040	0.0025	0.0015
1/4	0.0070	0.0050	0.0025
1/2	0.0100	0.0075	0.0040
3/4	0.0130	0.0100	0.0060
1	0.0160	0.0120	0.0075

Drilling speeds are as follows:

Steel	Brinell No.	Drill speed, surface ft. per min.
Group 1	170–200	110*
Group 2	170–200	85–90*
Group 3	170–200	65**
Group 4	170–200	70–85**
All	240–255	50**
All	300	40
All	350♯	20
All	400♯	15

* With soluble oil cutting fluid.
** With sulphur-base cutting fluid.
♯ Cobalt high-speed or similar drills are recommended.
Group 1 — NE 8000 grades, except 8339, 8442, 8630, 8735, 8739, 8744, 8749, 8949. NE 9415, 9420, 9422.
Group 2 — NE 1300 grades. NE 8339, 8442, 8735, 8739, 8744, 8749, 8630.
Group 3 — NE 8949. NE 9500 and 9600 grades, and the NE 9400 grades, excepting those in Group 1.
Group 4 — The NE 9200 and 52100 grades.

Armament

SECTION OF AMERICAN MACHINIST

IN THIS SECTION

HEAT-TREATMENT OF ALUMINUM AIRCRAFT PARTS
SPRAY BOOTH GIVES QUICK QUENCH
WELDING JIGS FOR NACELLE SUBASSEMBLIES
SEAMLESS BOMBS FROM STEEL PLATE

Heat-Treatment of Aluminum Aircraft Parts

BY T. E. PIPER
Process Engineer, Northrop Aircraft, Inc.

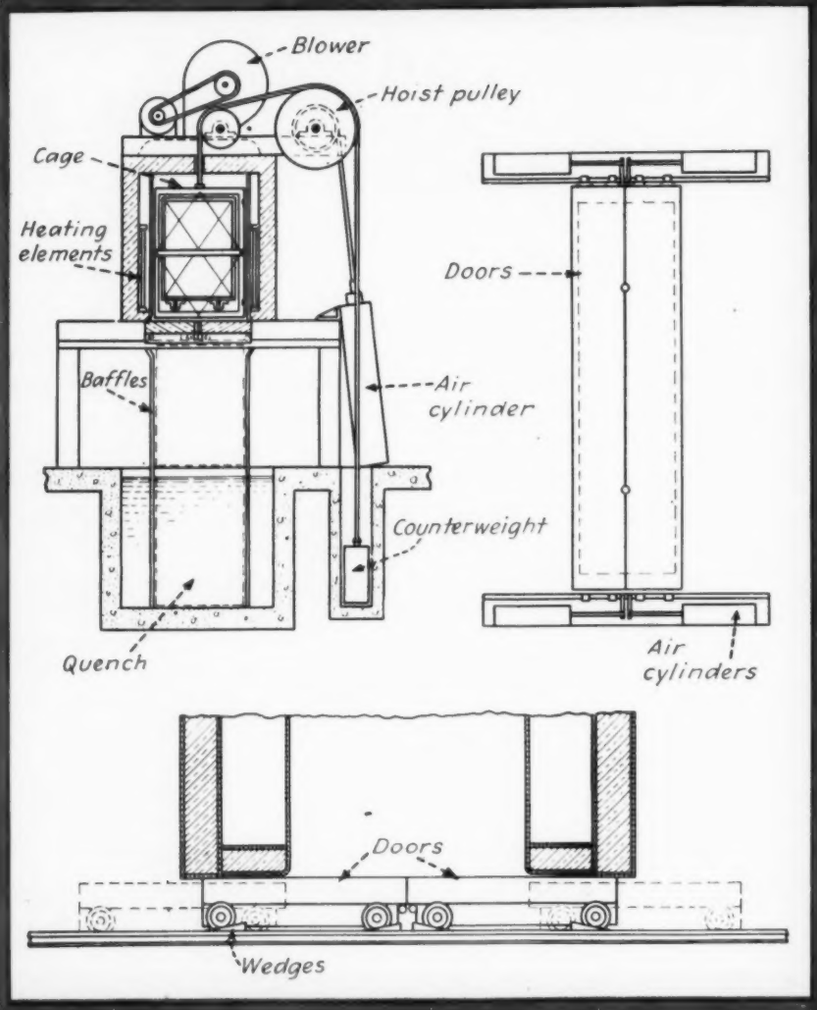
More harm than good may be done duralumin in heat-treatment unless the time between furnace and quench tank is held to a minimum

ALUMINUM ALLOYS are extremely sensitive to heat-treatment. Their hardness, tensile strength and especially their resistance to corrosion depends almost entirely upon this process. Alloys 17S, A17S, Alclad 17S, 24S, Alclad 24S, 53S and 61S may be hardened by heat-treatment, cold work or a combination of both. Casting alloys 142, 195, B195 and 356 are also sensitive to heat-treatment.

A typical alloy of this group contains aluminum, magnesium, manganese and copper, and combines these elements in solid solutions at temperatures somewhat above 900 F. The heat-treatment for this particular alloy requires that it be brought up to a temperature of 950 F. and maintained there for a half hour or more, depending on the thickness. The result of this treatment is that the elements are substantially put into solid solution.

If the temperature is reduced to slightly below the critical value, crystals or grains start to form within the body of the material, and the copper segregates out of solution to form a lattice or network between the grains. The more slowly the material cools, the larger will be the grains, and the greater will be the segregation of copper.

When an alloy in which such copper precipitation has occurred is exposed to moisture, salt or other cor-



The furnace charge is loaded on a rack, rolled into an elevator, hoisted into the overhead furnace and then dropped into the quench tank directly below the furnace

Elevator and doors on this Northrop furnace are actuated by pneumatic cylinders. When the doors are closed they are raised by wedges to seal the bottom opening

rosive influences, the copper is first attacked resulting in inter-granular, or inter-crystalline corrosion. A specimen in which such corrosion has occurred is useless for structural purposes; although its appearance may not indicate that anything has happened to it, it may be so lacking in strength as to fracture or even crumble under slight stress.

Ordinary tests of tensile strength or hardness on a newly fabricated part will not indicate when such segregation has occurred, and only micrographic examination and corrosion tests followed by micrographic examination will indicate whether or not the parts are suitable for use as structural members.

In aircraft structures, made of such materials, the reliability of the parts is directly affected by the speed with which they have been cooled from the heat-treating temperature. Ordinarily the parts have relatively large surfaces in comparison to their mass and lose heat rapidly when exposed to the air. Every effort is made to remove them from the heat-treating furnace, and introduce them into the quenching bath in as short a time as possible; but with most equipment now available, the period between removal from the furnace and quenching is of the order of some 10 to 20 seconds. Ten seconds is greater than is desirable, and 20 seconds is dangerously long.

In order to overcome this objectionable delay and to get maximum metallurgical benefits from heat-treatment, a special furnace is used for dural parts by Northrop Aircraft, Inc. This furnace is built directly above the quenching tank so that the heated parts can be dropped into the quench within two seconds after they leave the furnace.

In addition to reducing the time interval between the furnace and the quench, the equipment is arranged so that it requires no manual handling in the quenching process, gives full control by a single operator, is independent of the size of the charge to be heat-treated, and consumes only a minimum time for the furnace opening with a correspondingly small loss of heat.

The dural parts to be heat-treated are loaded on a rack, keeping enough space between them to insure uniform heating and cooling. The furnace is provided with a cage, or elevator, which in its upper position is in the heating chamber, and in its lower position in the quenching tank. The furnace is supported above the quenching tank a sufficient distance to provide an intermediate space for the cage; in this position the bottom of the cage is at floor level so the work rack can be readily loaded and unloaded.

The cage is hoisted and lowered by means of a cable actuated by a pneumatic cylinder through a pair of pulleys which give the length of travel desired. A counterweight balances the weight of the cage and the furnace charge.

The furnace is inclosed on all sides except the bottom, which may be closed by a specially designed pair of doors. These doors move horizontally on tracks and in their inner position entirely cover the furnace opening. In this position, also, the wheels carrying the doors run up on wedges lifting the doors and holding them tightly against the opening. The doors are moved in and out by means of horizontal pneumatic cylinders.

As an additional precaution against rapid cooling,

SOLUTION HEAT-TREATING (SOAKING) TEMPERATURES

Alloy	*Temperature*
A17S, 17S and Alclad 17S	925–950 F.
24S and Alclad 24S	910–930 F.
53S and 61S	960–980 F.

SOAKING PERIOD FOR SOLUTION HEAT-TREATING

Thickness of Material	*Annealed Material 17S-Alclad 17S*	*Heat-Treated Material 24S-Alclad 24S*	*Annealed or Heat-Treated 53S and 61S*
0.020 and less	15 min.	20 min.	15 min.
Over 0.020 to 0.032	20 "	25 "	15 "
Over 0.032 to 0.063	25 "	30 "	15 "
Over 0.063 to 0.125	30 "	45 "	20 "
Over 0.125 to 0.250	50 "	60 "	30 "
Over 0.250 to 0.500	90 "	90 "	45 "

Note: Values given are only approximate.
Time of soaking begins after furnace has returned to solution heat-treating temperature (following insertion of material).
Care should be taken to avoid prolonged heating of 17S and 24S Alclad.

A cross-section of 0.040 Alclad 24 ST shows eutectoid melting. The lighter layer on top is the pure aluminum coating. The duralumin below has segregated in globular form because of temperatures in excess of 936 F., followed by slow cooling

NUMBER OF REHEAT-TREATMENTS OF 17S AND 24S ALCLAD

Thickness of Material	*Material Purchased Annealed and Heat-Treated*	*Material Purchased in Heat-Treated Condition*
Inch	*Max.*	*Max.*
0.032 and less	0	1
Over .032 to 0.063	1	1
Over 0.063 to 0.125	2	2
Over 0.125	3	3

Note: Anodized 17S and 24S may be reheat-treated repeatedly. Unanodized 17S and 24S sheet material may be reheat-treated once.

baffles at the sides of the hoist protect the cage from air currents. These baffles have bright inner surfaces in order to limit heat losses by radiation as well as by convection.

Heat is supplied to the furnace by means of electric resistance elements on either side of the charge. A motor-driven blower on top of the furnace circulates the air to give uniform heating.

After the work rack is loaded, it is pushed into the cage. A pair of holes in the doors permit passage of the elevating cables. The doors are then open and the charge is hoisted upward into the heating chamber.

Temperatures range from 910 to 980 F., depending on the composition of the material. The temperature of the furnace at the time the parts are inserted is the same as the heat treating temperature.

Length of Soaking Period

The soaking period depends both on the thickness and the composition, and varies between 15 and 45 min. Because of this variation, charges of parts of different thickness should be avoided whenever possible. In any case the soaking time for the greatest thickness should not exceed four times the minimum time for the smallest thickness.

The furnace may also be used for annealing, using temperatures of 625 to 810 F. and cooling in air.

In heat-treating, when the soaking period is completed, the operator operates a valve to open the furnace doors and a second valve to lower the elevator into the quench. All wrought alloy parts should be quenched in cold water not over 85 F. at the time of the quench.

After quenching, the cage is raised again to the loading level, while the work rack is wheeled off for unloading. Meanwhile, another rack has been loaded and can be rolled into place, thus keeping the furnace in continuous operation.

The fast action of this equipment enables it to turn out heat-treated parts in which no segregation in the material can be detected.

ANNEALING TEMPERATURE (Cool in Air)

2S, 52S, 56S	625 to 700 F.
3S, 4S	725 to 775 F.
17S, 24S, 53S, 61S — Work hardened from SO condition	640 to 670 F.
17S, 24S, 53S, 61S — Partial Anneal Material Previously Heat-Treated	750 to 800 F.
17S, 24S, 53S, 61S — Full Anneal Material Previously Heat-Treated	790 to 810 F. (Soak 2 hr. Cool slowly to 450 F. then air cool.)

Note: 17ST and 24ST Alclad should not be fully annealed when hardness was caused by previous heat-treatment.

Spray Booth Gives Quick Quench

Workers roll a rack loaded with duralumin parts into one of a battery of heat-treating furnaces at the Texas plant of North American Aviation. The under-carriage remains outside the furnace

BY ROYAL B. JACKMAN
North American Aviation, Inc.

HEAT-TREATMENT of aluminum parts for aircraft, like many other phases of manufacture in this industry, requires a special technique. Under the stress of war production a number of heat-treating processes have been evolved. One of these is now being employed successfully by the Texas Division, of North American Aviation, Inc.

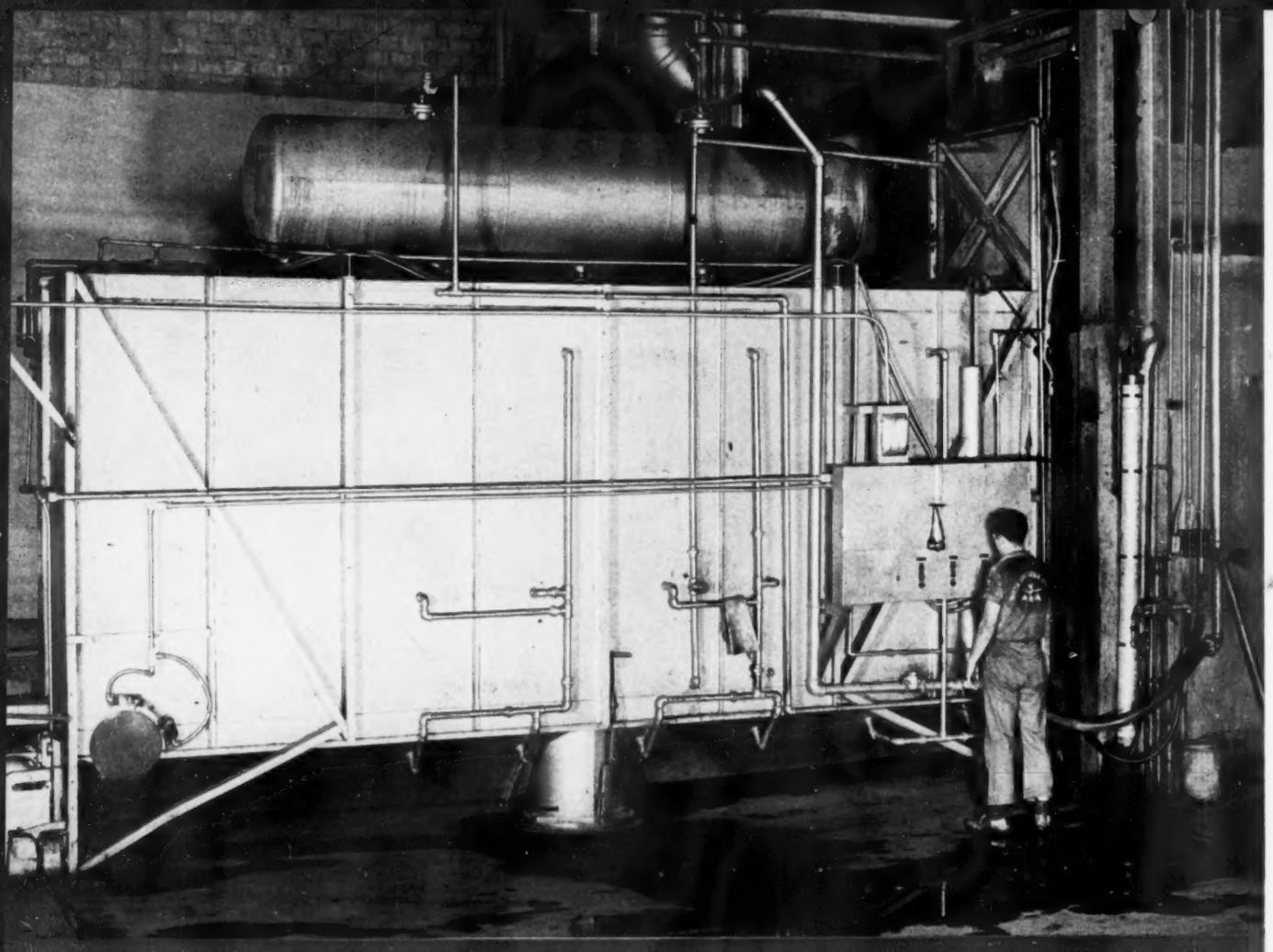
A big part of heat-treatment in this field is material handling. This company is installing equipment to bring parts to and from the heat-treating department by a continuously moving overhead conveyor. The furnace set-up is designed especially to facilitate handling the parts.

Other considerations in heat-treating aluminum components are the proper support of flimsy or odd-shaped pieces and the quick transfer of heated parts from the furnace to the quench. The method of quenching must be fast and thorough, yet not so drastic that excessive distortion will be caused.

North American has met these requirements by heat-treating equipment, designed by company engineers, which consists of a loading rack, a long narrow furnace and a quenching booth. The rack is made of steel tubing, welded to form a frame approximately $3\frac{1}{2} \times 5 \times 12$ ft., with expanded metal platforms at the top and bottom. The tubes which form the frame are perforated in a few places to permit the escape of any vapor that might form in them when heated.

The expanded metal allows free circulation of heated air around the racked parts. The upper platform provides a convenient carrier for wires on which the work pieces are strung. The lower expanded metal platform supports the larger parts. These are packed with small pieces of expanded metal and asbestos so they will not lose shape when heated.

The rack has six wheels which roll in two channel irons that form tracks on the top of an under-carriage. The height of the carriage corresponds to the



Here the quenching booth is in position in front of the heat-treating furnace, and the operator is at the controls which raise the furnace door and pull the loaded rack out of the oven into the booth

level of the track in both the furnace and the quenching booth so there is no raising or lowering of the furnace charge at any time.

The loaded rack, on the under carriage, is rolled in front of one of the furnaces. The furnace door is opened pneumatically, and the rack is pushed in by hand, its wheels fitting tracks inside the furnace.

North American uses 24 SO Alclad for its heat-treated aluminum parts. These are heated to 920 F. ± 10F. and quenched in a water spray.

Heat is supplied indirectly by means of a heat exchanger located in back of the furnace. The exchanger consists of a combustion chamber with two gas jets on either side. The products of combustion rise through a series of 27 percent chromium stainless steel tubes. Air is circulated around the tubes and through the furnace by a No. 28 Buffalo volume blower. Baffles are arranged around the tubes so the air from the furnace makes four passes across the tubes, flowing in a direction opposite to that of the burned gases. The heating arrangement keeps the products of combustion away from the furnace charge.

The furnace is equipped with gratings, above and below the work-carrying rack, on which are laid sheets of metal to form hot air ducts. The metal sheets are spaced further apart at the front of the furnace than at the rear in order to equalize the heating for the full length.

The temperature is controlled by Leeds and Northrup recording pyrometers. Each furnace contains eight thermocouples with a selective switch so that any one of them can be read. Thermocouple No. 6 is used for operating control as this has been found to be the mean position.

Parts are left in the furnace for approximately 30 min., depending on their size and thickness. When they are ready to come out, the quenching booth is moved in front of the furnace door. The design of this booth is the core of North America's heat-treating process.

The booth is an inclosed chamber, dimensioned to receive the work-holding rack. It is mounted on wheels which roll along tracks that carry it transversely across the floor, so one booth can serve three

SPRAY BOOTH GIVES QUICK QUENCH

A look into the interior of the spray booth, after it has been rolled away from the furnace, shows the positions of the work carriage and the spray nozzles

or more furnaces. The movement of the booth along the tracks is powered by a 5-hp. motor which drives the wheels through a chain and worm-and-wheel reduction unit.

A second motor operates a chain conveyor inside the quench booth. This unit also has a gear reduction drive. The conveyor is arranged to pull the rack from the furnace into the quenching booth which is provided with tracks to receive it. An end section of the track is pivoted to span the space left by the booth door and furnace door.

On top of the booth there is a 400-gal. water tank which supplies sprays above, below and on either side of the booth. Pressure is applied by 90 lb. per sq. in. of air above the surface of the water. An open pipe in the bottom of the booth empties the water into a floor drain.

Quenching is also aided by an exhaust fan, located outside the building, which pulls air and water vapor through the spray booth, the charge and the floor drain. The quenching water, cooled by vaporization, runs into the sump and is used over and over again.

Once the booth is put into place and the furnace door opened, the operating cycle is automatic. An extension of the conveyor shaft carries a disk with two dogs on its periphery to actuate limit switches. When the operator presses a button the cycle is as follows:

The chain conveyor moves toward the furnace carrying a pawl which links with a crossbar on the rack. At this instant the first switch reverses the conveyor and opens the water valve to start the sprays. When the rack is completely inside the spray booth the second switch closes the booth door and stops the conveyor.

During this cycle the overhead water tank is connected to a 100-lb. air line by means of a 1-in. hose to maintain pressure on the sprays as the tank empties.

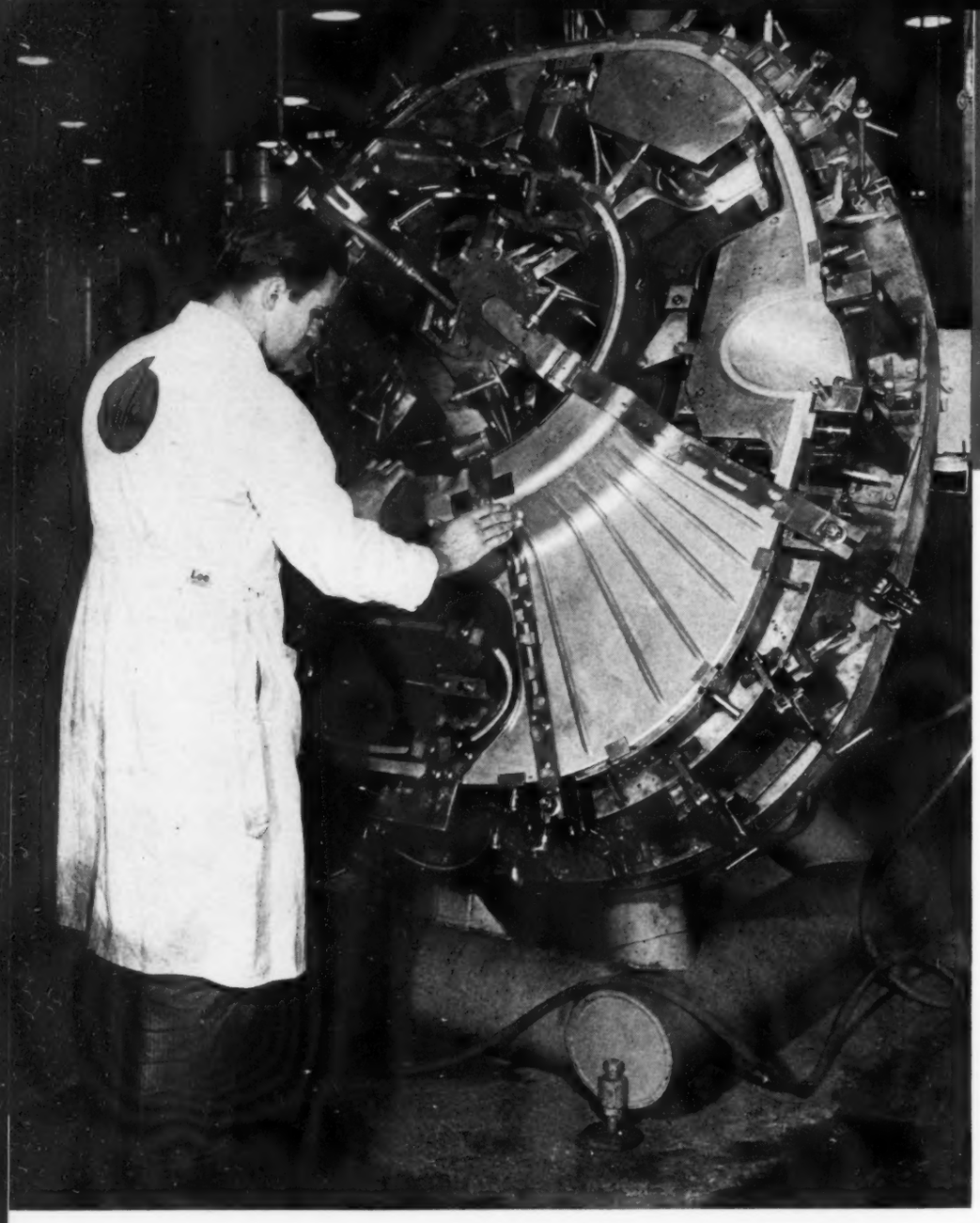
When the quench is completed the booth is rolled opposite one of the carriages which has been placed between two of the furnaces. The door is opened by push button which also operates a solenoid to close the spray valve. Then the conveyor is employed again to unload the rack from the booth and deposit it on the carriage. The spray booth tank must be refilled with water from the storage sump after each quench.

Parts are received from the rack and hung on hooks paralleling the furnace walls. Here they dry quickly and are later transported by conveyor to the subassembly departments.

The operating cycle of this furnace insures quick transfer from the heating to the quenching zone. The spray quench gives rapid action with a minimum of distortion.

Welding

BY PAUL MITCHELL
Project Tool Engineer,
Vultee Aircraft, Inc.



Stainless steel parts are located on a welding jig to fabricate the inner ring

With all sections in place the inner ring is welded; the pressure gun is shown guided by the plate that locates spots in one of the reinforcing "doublers"

TRADITIONAL METHODS of assembling the nacelle inner ring and muff have been discarded by Vultee in favor of a process that employs newly designed jigs. Each of these two aircraft subassemblies, which fit together to inclose the engine manifold, is made up of a number of stainless sheet steel parts. Despite their large size and the flimsiness of the material of which they are composed, the finished units are made to exacting tolerances at a fraction of the time formerly required for this work. The all-welded construction gives great rigidity and eliminates many time-consuming hand operations.

The inner ring is made up of approximately 35 pieces of stainless sheet. The parts are blanked and formed to shape before reaching the jig. Each is fitted to an inspection gage to insure accuracy; the process is designed for quantity production and no hand adjustments in the parts are permissible in the jig.

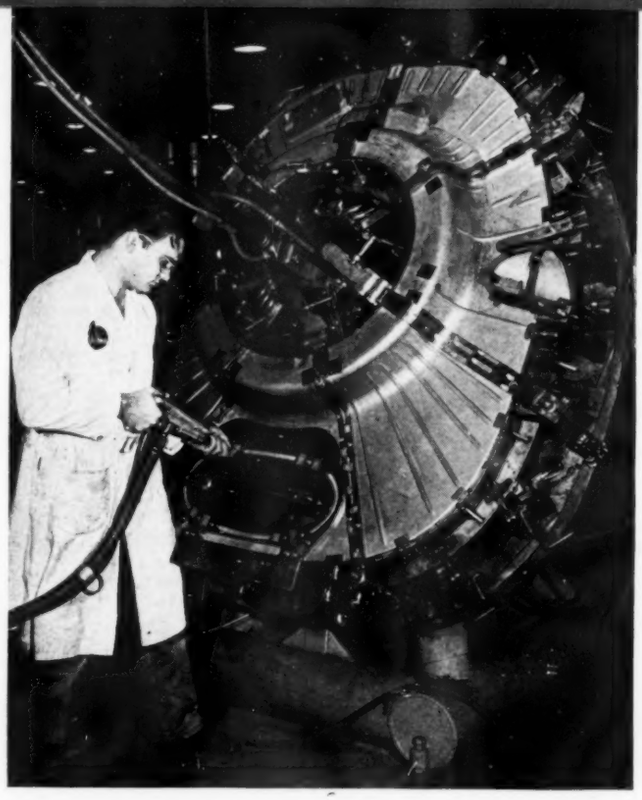
The general procedure is to fit the parts into place, lock them securely and then tack weld them sufficiently to make the subassembly self supporting. Final welding is done in a standard floor type spot-welding machine.

The jig consists of a cast iron base plate, weighing some 1,500 lb., supported at an angle of 70 deg. from the horizontal on a frame of heavy welded tubular construction. Each of four supporting points has a screw adjustment to give the jig firm contact with the floor. The base is mounted on the frame in roller bearings in which it can be rotated freely through an angle of 300 deg. Two stops limit the travel so the electrode connections will not become twisted. The 70-deg. angle to which the base plate is set was selected arbitrarily to afford a convenient working position. The rotation of the plate gives easy access to any part of the subassembly.

The inner ring consists of seven segments or baffles

Jigs for Nacelle Subassemblies

Special tools speed spot-weld fabrication of stainless steel parts at Vultee Aircraft, Inc.



0.018 in. thick. These are joined by a series of 0.025 in. inner flanges, outer flanges and channels along the radial joints. In addition there are two shrouds, shaped as conical segments, and two doublers, or flat reinforcing members.

Seven inner sections of the jig are mounted on slides and can be moved radially inward or outward. They are attached by links to a central spider or star wheel which is rotated by a pneumatic piston. A control lever at the periphery of the jig actuates an air valve which moves the jig sections. The outer positions are positively fixed by stop pins as they determine the location of the parts for welding. The expanding and collapsing construction of the jig is essential to free the subassembly when welding has been completed.

The sections of the jig which hold the outer flange pieces are also mounted on radial slides but these are moved manually and held in position by toggle clamps. These sections carry a series of flat lugs which extend over the flanges to hold them securely in place.

All jig sections which back up portions of the subassembly to be spot welded are faced with copper plates or strips connected by cables to a central terminal.

The inner and outer flanges are placed on the jig first. The outer flanges are located angularly by pins which fit into the jig sections through carefully tooled holes. Each of the baffles has two smaller holes which locate it over pins on the flat face of one of the inner jig sections. Most of the other parts are positioned by the contour of the jig itself.

There are four loose parts to the jig which are applied after the sheet steel pieces are in place. Two of them hold the shrouds and the other two hold the doublers. These act as auxiliary clamping members; they are positioned by heavy steel pins and secured in place by eccentric cams.

Seven radial arms are pivoted to the center section of the jig. They are held up, out of the way, by lock pins while the jig is being loaded. These arms are shaped to fit the radial channels which cover the seams between the baffles. When the baffles and flanges are in place the arms are swung downward to clamp the channels and are held securely by toggles attached to the periphery of the baseplate.

The arms and other clamping members are cut away to provide clearance for the welding gun. The holes and slots used for this purpose serve as templets for the welder.

When all parts are assembled and clamped firmly in place, a pressure gun is used for spot welding. The gun and its 50-kva. Federal transformer are carried on an overhead monorail trolley so they can be swung out of the way when the jig is being loaded and into position above the jig during welding. The gun is counterbalanced. The return electrode is fastened to the copper terminal at the center of the jig by means of one quarter turn of a screw. Poth the gun and the lead-in cable on the jig are water cooled. The gun is set to about 60 lb. pres-

sure; the welding cycle is controlled by an automatic timer.

The spots are made about 3 in. apart as the jig is rotated to bring various sections of the work into convenient position; it can be locked at any point by means of a pedal-operated pneumatic brake. The rigid positioning thus obtained prevents spoiling the welds through slippage. About 200 welds are made with the inner ring in the jig. Then the subassembly is unclamped, the loose jig members removed and the subassembly is taken to a 150-kva. Federal spot welder. Here all remaining spots are added to complete the subassembly.

Base for Muff Jig is Stationary

The jig for the muff is similar but has some basic differences. It uses a heavy baseplate made from the same pattern as that for the inner ring jig. It is mounted on a heavy tubular frame with adjustable screw supports.

However, the base for the muff is stationary and horizontal. A yoke type gun is used instead of a pressure gun. Again both the transformer and counterbalanced gun are carried on a monorail trolley, but for the muff all welding is completed with the work in the jig.

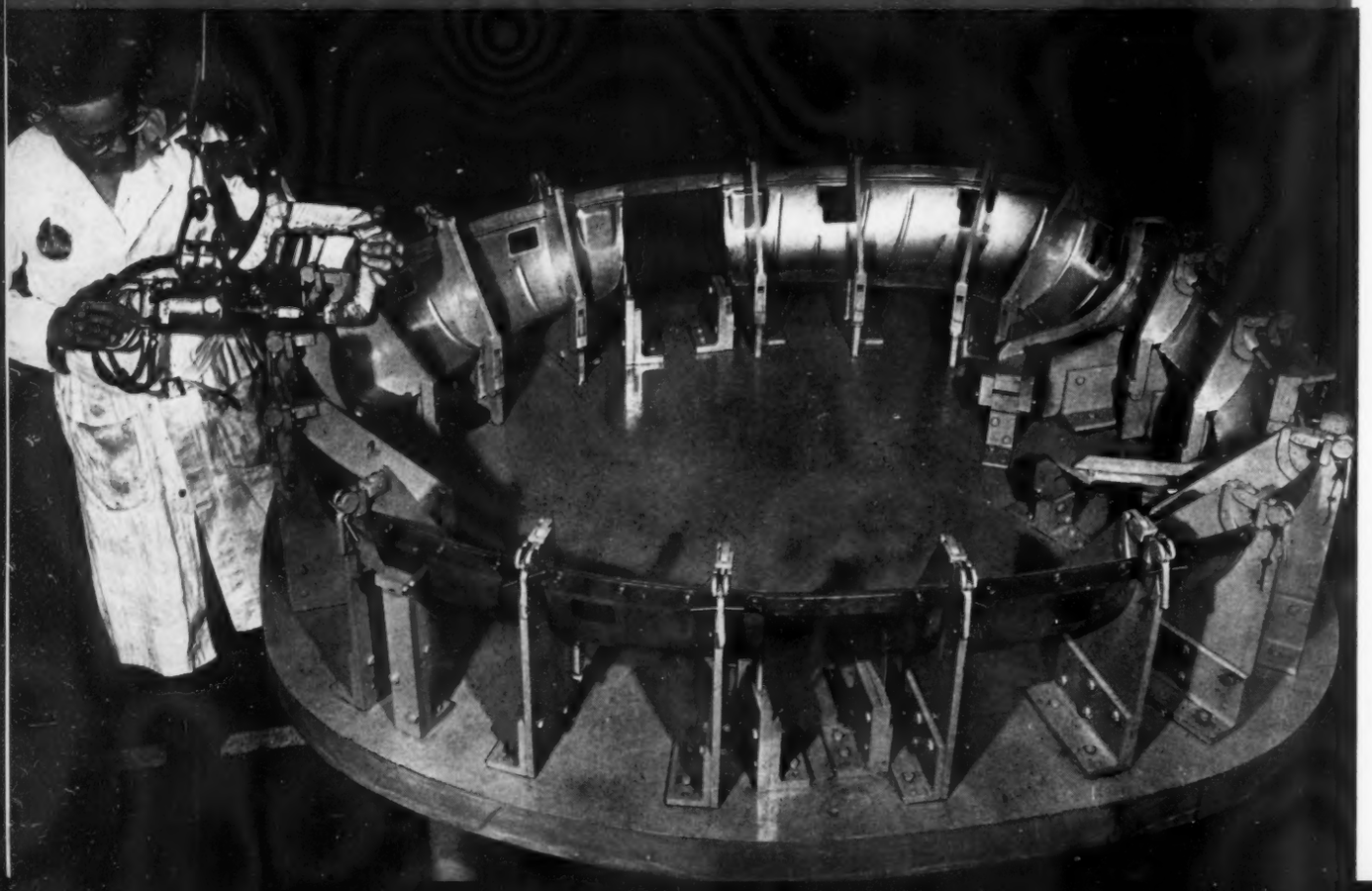
The muff consists of approximately 30 preformed stainless steel segments and reinforcing pieces. It is locked in place by hand-actuated toggle clamps. Since the upper edges of the muff segments are important, double-acting clamps are used. These not only grip the segments but have a lifting action on the stiffener rib to draw the pieces upward against stop pins. This action is facilitated by flat leaf springs in the base of the jig locating points. The stop pins are held in position by helical springs. They are pulled outward to insert the parts and remove the subassembly on completion.

A series of copper strips with holes in them encircle the periphery of the muff when it is located in the jig. The spots are made through the copper; the holes are used as locating points for a hand punch which puts the fastener holes in the muff after it is welded.

All circumferential and radial seams are welded in the jig. The muff assembly is in two parts, separated by a gap in the jig. When the work is removed it is completely welded.

Use of these two jigs avoids drilling holes in place and spot riveting prior to welding. It eliminates all hand fitting. Fastener holes in the inner ring and the muff match each other without further adjustment of any kind. Both assemblies are stronger and more accurate than when made by the old method.

The muff jig is horizontal and is arranged for use with a yoke type spot-welding gun



All photographs by U. S. Army Signal Corps

Seamless Bombs From Steel Plate

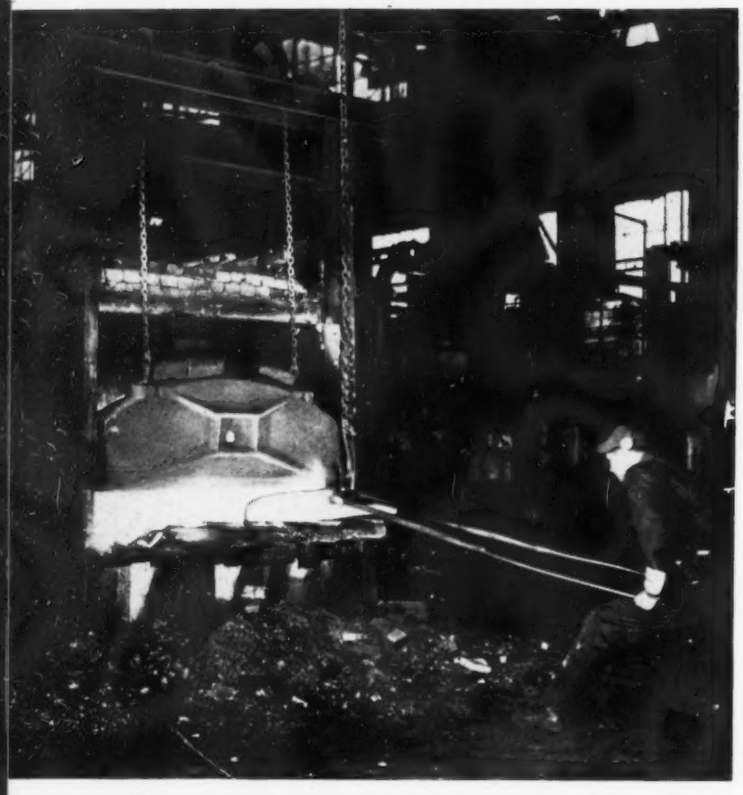
By J. B. NEALEY
Ordnance Department, U. S. Army

BOMBS, LIKE CYLINDERS for compressed gases, can be produced from steel plates. Early in the defense effort, long before Pearl Harbor, Ordnance Department engineers recognized that the Harrisburg Steel Corporation had available equipment and manufacturing experience in the production of gas cylinders that could be used to advantage in making bombs. A contract was negotiated and the production of bombs has been carried on by that organization since that time.

For bomb making, 6,000-lb. slab ingots are poured from oil-fired open hearths. When these 13 × 31-in. ingots have been stripped from the molds, they are reheated in soaking pits fired with producer gas. They next are reduced in a two-high 32-in. blooming mill and rolled, on the same mill, to form a thick strip. Chemical analysis of the steel does not enter into the Ordnance specifications. The manufacturer has considerable latitude in the composition of his steel. While chrome molybdenum steel was used by this firm in making gas cylinders, and while this steel proved satisfactory for bombs, the steel is on the critical list. Therefore, a carbon steel high in manganese was selected, as it acquired the specified physical properties with proper heat-treatment.

Steel strip from the blooming mill is sheared into plates $31\frac{1}{4}$ in. square and $1\frac{7}{8}$ in. thick. As these accumulate before using, they lose most of the soaking pit heat, and must be reheated. This is done in oil-fired furnaces, each about 36 ft. long, into which the plates are charged by an electromagnet suspended from an overhead hoist. Temperature is controlled

SEAMLESS BOMBS FROM STEEL PLATE



The first operation in the manufacture of seamless steel bomb bodies from plate stock consist of heating the plates to about 2,100 F. in a reducing atmosphere

and recorded by automatic equipment, and an automatic proportioner mixes the oil and air fed to the twelve burners which supply heat to each furnace. These burners, arranged with six on each side of the furnace, fire directly into the heating chamber just above the hearths.

The desired loose, dry scale is obtained by so controlling the furnace atmosphere as to make it slightly reducing. When the plates have attained a temperature of about 2,100 F. they are removed from the furnace and put through a series of hydraulic press operations.

Plates are removed one at a time by a furnace attendant, using long handled tongs that are suspended by chain from an overhead monorail trolley. First, the white-hot plate goes to a 250-ton press where a 31-in. disk is punched from the center. This disk drops onto a rest on a tip-up roller conveyor of short length. Most of the scale is on the top surface, that on the bottom having been rubbed off in placing the plate in the piercing press. For this reason the hot disk is turned over, as the conveyor rises to the horizontal position, and then is moved into the second press with its clean side up.

The second and third operations consist of drawing

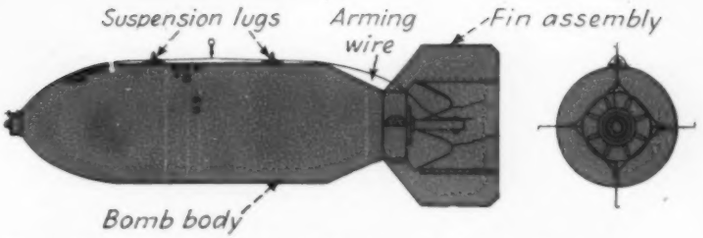
A 31-in. diameter disk is punched from the 1 7/8 in. thick plate in this 250-ton hydraulic press. The disk drops through the die onto a tilted conveyor section

the disk into a cup shape. Each of these operations is performed in a 200-ton hydraulic press; the first forms a shallow cup while the second reduces the cup diameter and extends it in length. In each press the piece is pushed through an open die ring by a round-nosed punch on the ram. No lubricant is needed for the piercing or the first cupping operation, but a mixture of oil and graphite is employed for the second cupping operation. Scale inside the cup is broken up with water after this third operation. By this time, the metal has lost about 300 F. of its temperature, and must be reheated.

The cups are charged into an in-and-out furnace about 25-ft. long with four doors. Of slight depth, this furnace is fired by twelve oil burners located in the back wall. When a temperature of about 2,100 F. has been attained, the cup is removed by tongs and transferred to a draw bench where it is forced through a series of draw rings. Handling between furnaces, presses and draw benches in this department is by hand tongs suspended from a monorail trolley by a heavy chain. Each of the hydraulic horizontal draw benches is of 200-tons capacity. Wheeled trucks on rails support both the piston and the draw mandrel during their travel.

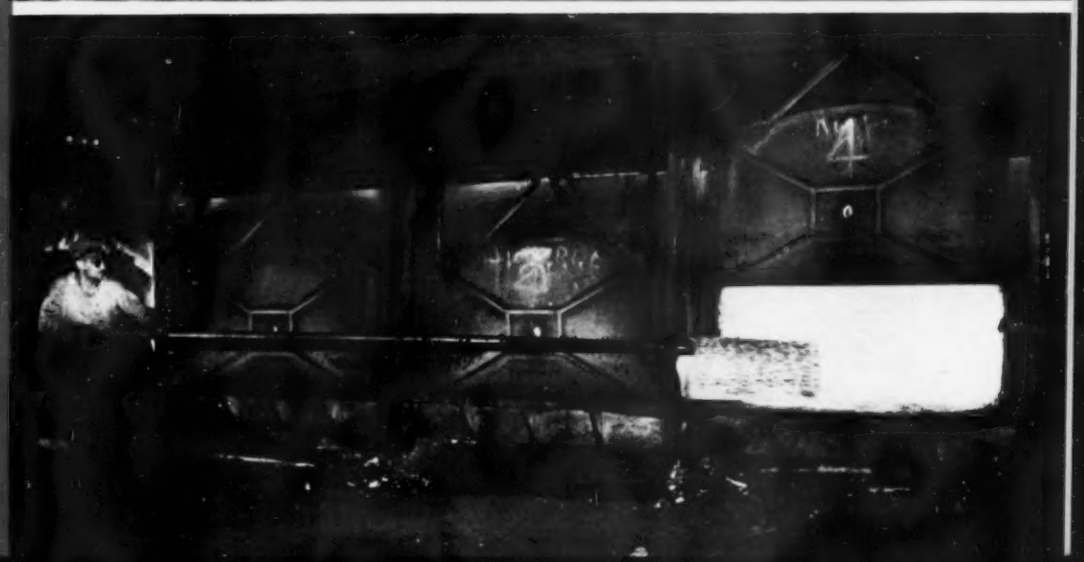
As the hot cup is placed in the draw-bench guide, an air blast at 100 lb. per sq. in. pressure breaks up and blows out the scale from the outside. The round-nosed mandrel is swabbed with an oil and graphite lubricant, and then moved forward to push the cup through seven draw rings. Ram stroke is 17 ft. A stripper ring at the end of the bench removes the elongated cup from the mandrel when the ram is returned to the starting position. Between draws, the manded is cooled with water.

Seven draw rings are necessary on the first draw bench, as considerable break-down is accomplished. If this breakdown were too rapid, it would deform



The 500-lb. demolition bomb has great destructive power for its weight. It is fitted with a delayed-action nose fuze so the bomb can penetrate into its object before exploding. The tail fuze makes detonation more positive

Reheated cups are drawn through seven rings in a 200-ton, 17-ft. stroke hydraulic draw bench. The round-nosed mandrel, covered with an oil-graphite lubricant, and the ram are supported by a wheeled truck during the draw and return stroke



The bomb tube must be reheated between the two draw bench operations, as too much heat is lost during the first draw to permit finishing immediately. The inside surfaces are descaled before the tube is placed in this furnace

At the second draw bench the bomb tube is drawn through three rings in a 20-ft. stroke. The workman at the left holds the lever controlling the ram while the worker at the right directs a jet of water on the ram

or stretch the bottom so thin that it might be ruptured by the mandrel. Too much heat is lost in drawing the cup through these seven draw rings to permit finishing by adding more rings to the first draw bench. It is necessary to reheat the cylinder and then perform a second draw-bench operation.

Before reheating, the interior of each cylinder is descaled with a jet of water at 1,800 lb. per sq. in. pressure. Then the cylinders are brought back to about 2,100 F. in one of several oil-fired furnaces and finish drawn in the second draw bench. This bench is like the first, except that it has a stroke of 20-ft. and uses only three draw rings. The small amount of scale formed during this operation is easily removed by an air jet. Draw rings used in both draw benches are of either alloy steel or of carbon steel faced with Stellite.

The ragged end of each finished tube is sheared off in a 100-ton hydraulic press fitted with a stake to hold the inside cutting blade. A small section is sheared off at each stroke of the press, and an operator turns the tube by hand between each stroke. A very clean cut is obtained. Next, the tube is chucked in a 24-in. engine lathe and the closed end is removed with a parting tool. The product now is a seamless tube with the same wall thickness and diameter throughout its length.

This seamless tube now must be formed at each end to provide the final bomb shape. First, one end of the tube is introduced into a slot-type furnace, some 10-ft. long, heated with an oil burner firing from each end. When the end of the tube is heated to about 2,100 F. the tube is transferred to a 1,600-lb. steam hammer equipped with a two-part necking die. The upper die then is operated at about 125 strokes per minute to close the tube end and form the nose. This process must be fast, because the wall thickness is so thin in comparison with the mass of metal in the dies that the tube chills quickly. This nosing operation is completed in a single heat. The hammer is specially built with a wide base to resist the unusual side thrust accompanying this operation. The overhead rails, from which the handling tongs serving these hammers are suspended, are in the form of closed loops.

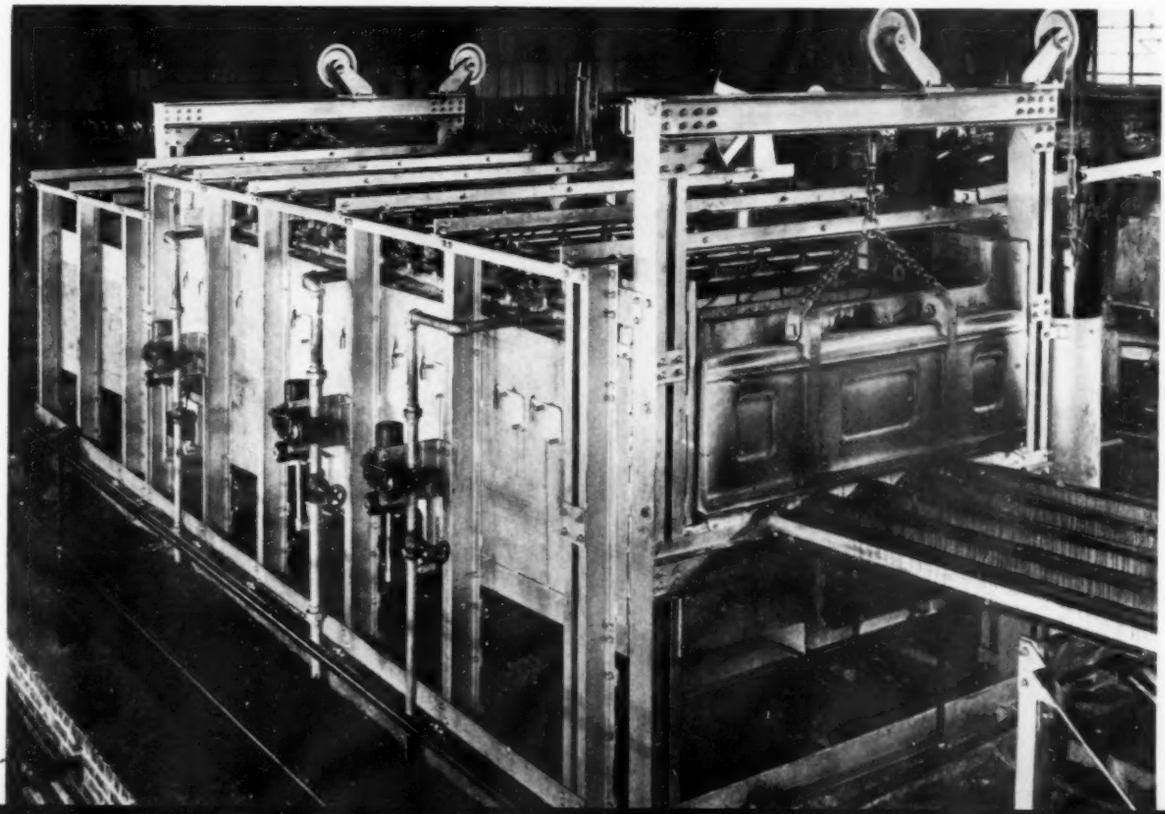
Next, the other end of the tube is heated to 2,100

SEAMLESS BOMBS FROM STEEL PLATE

The ragged open end of each tube is sheared off at a 100-ton hydraulic press. An operator turns the tube by hand between each stroke of the press

One end of the seamless tube is nosed-in at a 1,600-lb. steam hammer operated at 125 strokes per minute. This rapid operation of the upper die is necessary so the bomb can be formed before thin tube wall cools too much

The continuous-type of heat-treating furnace employed for heat-treating and stress relieving finished bomb bodies are fitted with improved radiant gas burners. High thermal efficiencies are obtained



F. in another slot-type furnace and then reduced to a cone shape with a short neck in another 1,600-lb. steam hammer. Heat-treatment and quenching follows to produce the proper physical properties. Each bomb body is heated to 1,600–1,650 F. for about 1½ hours, and then quenched. After two suspension lugs have been welded in place, another heat-treatment for stress relieving is necessary. Ordnance engineers specify that the temperature for this heat-treatment shall not be less than 1,000 F., nor higher than the low critical of the steel—which is approximately 1,300 to 1,350 F. They also specify that the work shall be held at temperature for half an hour.

The furnaces employed for stress relieving employ a large number of an improved type of radiant gas burner, with the burners arranged in patterns in the roof. This arrangement affords a wide area of incandescence radiating heat down onto the work. These burners are of the refractory-cup direct radiant type, and premixed gas and air is burned from a number of points in the base of each cup. More than a ton of steel per hour is heated in one of these furnaces, which measure 17 ft. long and 6½ ft. wide.

The bomb bodies next are shotblasted both inside and out with 100 lb. per sq. in. air pressure. They are then moved to the machine shop, where several minor machining operations are performed. First, the bomb is chucked in a lathe, using a three-jaw, air-operated chuck. Five tools in a hand-indexed turret then are used to perform the following operations on the nose end: (1) drill hole in nose, (2) true up nose hole with boring bit in bar, (3) undercut for thread, (4) ream, and (5) tap, using a Landis collapsible tap.

Rechucked in a similar lathe, with the tail end of the bomb outside the chuck, the cone end is faced off and bored. Finally, a driving plug is threaded into the tapped nose end. This plug then is seated on the live center of a third lathe and the cone end is supported by the tailstock center while the neck on the cone end is turned and threaded to receive the rear closing cap and tail fin locknut ring. It is essential to accuracy in bombing that the tail fin be in exact alignment with the longitudinal axis of the bomb. Therefore considerable care is taken when centering the bomb body when setting-up for this third lathe operation.

An acid-proof paint is sprayed on the interior and an ordinary primer coat is sprayed on the outside of the bomb. Suspension lug protection rings then are snapped around the outside of each body and the bodies are stacked in freight cars for shipment to some Ordnance Department arsenal where the high explosive charges are put in.

The nose end of each bomb body is drilled, bored, undercut, reamed and tapped in a heavy-duty turret lathe. The tail end is bored and faced in a similar set-up, then the body is held between centers for turning and threading the tail end in alignment with the longitudinal axis of the bomb

Fixture Welding With an Expansion Gun

Courtesy of the Vega Aircraft Corporation

FIXTURE WELDING is a special application of spot welding, which provides the accurate control of current and pressure required for welding aluminum alloys, yet retains the advantage of a light portable gun which can be easily shifted about the work. A fixture welder consists of: (1) a welding power supply; (2) a copper-faced locating fixture with insulated bus structure; and (3) an expansion gun with a hydraulic pressure system.

The copper-faced fixture locates the parts properly with respect to each other and also provides rigid mechanical support and good electrical contact at all points where welds are to be made. The insulated bus structures attached to the fixture are parallel to the contours to be welded and about eight inches distant. These bus bars back up the expansion gun mechanically and also conduct the welding current from the power supply to the gun.

Use of the Expansion Gun:

The expansion gun terminates in a spot-welding electrode at one end, in a large contact shoe at the other, and has a hydraulic cylinder in the middle to expand the length and put pressure on the welding electrode. The only attachments to the gun are a high pressure hydraulic hose and a light control cable, so that the gun is light and easily maneuvered.

After the parts to be welded have been properly located and clamped in the fixture, the expansion gun is placed between the bus bar and the assembly. When the control bottom on the gun is pressed, the welder control applies hydraulic pressure to the cylinder of the gun, causing the gun to expand and form an electrical and mechanical bridge between the bus bar and the work in the fixture. When the pressure developed by the gun has built up to the pre-determined value, the welder control allows a surge of metered welding current to pass into the fixture circuit, producing a spot weld where the electrode on the gun contacts the work. The welder control then automatically releases the hydraulic pressure and the gun retracts for movement to the next welding position.

Advantages of Fixture Welding:

1. Parts of an assembly are accurately located and welding is completed in one fixture. Temporary fastenings, such as clecos, PK's, tack welding, etc. and transferring between fixtures are eliminated.

2. Parts inaccessible for electrode arms of conventional spot welding machines can be spot welded with a fixture welder.

3. Assemblies too large to handle in conventional spot welding machine can be placed in the fixture and welded by moving the gun instead of the work.

Limitations of Fixture Welding:

Fixture welding is primarily a mass production method, as the cost of the special copper-faced fixtures for each weld assembly is generally justified only for large quantity output. However, by eliminating several fitting and sub-assembly operations, or by changing an otherwise difficult assembly operation into a simple fixture welding operation, fixture welding may provide a net over-all saving in fabrication cost on only a few hundred assemblies.

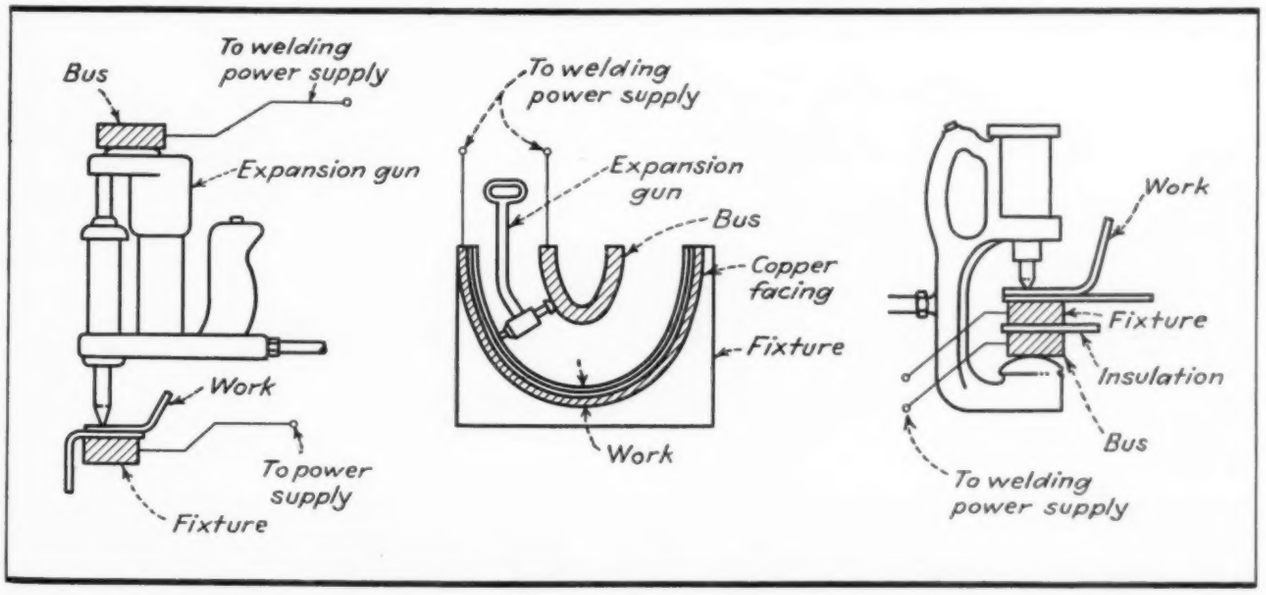
Design for Fixture Welding:

TYPES OF PARTS

Carburetor air scoops, oil cooler scoops, cowl rings, and nested parts are typical assemblies suitable for fixture welding.

MATERIALS

Aluminum alloys, up to 0.081 thick
Stainless steels, up to 0.125 thick
Low carbon steels (less than 0.25C), up to 0.091 thick.



STARRETT HACKSAWS

How To Get The Most Out Of STARRETT

HACKSAW BLADES

DO

Select the right blade for the stock. Be sure the length, width, thickness and number of teeth are correct.

Insert the blade with the teeth pointing in the direction of the cut.

Use recommended speed and feed for metal being cut. Increase pressure at intervals to compensate for blade wear.

Clamp the work securely to prevent shifting.

Use a cutting compound except for iron castings.

DON'T

Don't try to get good work out of a worn out or poorly adjusted machine.

Don't use a heavy blade in a light machine or for small work.

Don't over-strain the blade or run it with too little tension.

Don't let mounting pins become worn or out-of-round.

Don't start a cut with too much pressure.

Don't use a new blade to finish a cut started by an old one.

Don't waste time and power cutting with a worn out blade.

Starrett S-M Molybdenum Special Alloy High Speed Steel Hacksaw Blades are recommended for the tough, hard-to-cut metals and alloys, and Starrett Tungsten Alloy Blades remain the standard for cutting performance and economy on run-of-mill work. Order a trial supply from your mill supply dealer today.

THE L. S. STARRETT CO · ATHOL · MASSACHUSETTS · U · S · A ·

World's Greatest Toolmakers

STARRETT

PRECISION TOOLS • DIAL INDICATORS • GROUND FLAT STOCK
HACKSAWS • METAL CUTTING BANDSAWS • STEEL TAPES

Hot and Cold Press Forgings

Courtesy of the Vega Aircraft Corporation

HOT AND COLD press forgings should be definitely considered whenever the quantity of parts involved is sufficiently high or where a good, strong part is needed. One of the major differences between hammer forgings and press forgings is the fact that press forgings have much closer tolerances resulting in less machining time.

The difference in fabrication methods employed to make hammer forgings and press forgings is self-explanatory. Press forgings utilize press equipment with a resultant squeeze action and flow of material rather than a drop impact as in hammer forgings.

Parts adaptable for fabrication as press forgings range from the conventional hammer forging shapes with 7-deg. draft, fillet radii increasing with the height of a projection perpendicular with the parting line, and corner radii varying with the requirements of the finished part, to pure extrusions where metal from a diaphragm is extruded into a projection at right angles, and whose height is limited only by press capacity and blank volume.

The following are some limitations and tolerances:

Size: Projected area from the parting plane should not exceed 20 sq. in. for regular parts and approximately 15 sq. in. for irregular parts.

Fillet Radii: May vary from a slight break on an extruded projection to $\frac{1}{2}$-in. desired fillet on 2 in. or greater height drafted projection which may require progressive impressions.

Draft: Well balanced parts permitting positive ejection from the die need only slight draft, but parts with irregular and unbalanced projections are more economical with regular draft and fillets.

Thickness: Minimum diaphragm thickness of $\frac{1}{16}$ in. permissible on widths not over $\frac{3}{4}$ in. As a general rule use $\frac{3}{32}$ in. as a minimum diaphragm thickness.

Projections with minor dimensions not in excess of a 1 to 2 ratio to the diaphragm thickness may be produced at will, while a flanged sleeve or a closed cylinder may be 1 to 1 ratio or greater.

Bosses and Projections: Large bosses or projections remote from the main body of a part are more readily produced by hammer forging, where it is possible to flow more metal.

Sectional Variations: Bottlenecks such as thin sections, steps or sharp changes in the flow of metal are to be avoided, especially adjacent to bosses or where metal movement must be comparatively great. Also steps should be gradual wherever possible.

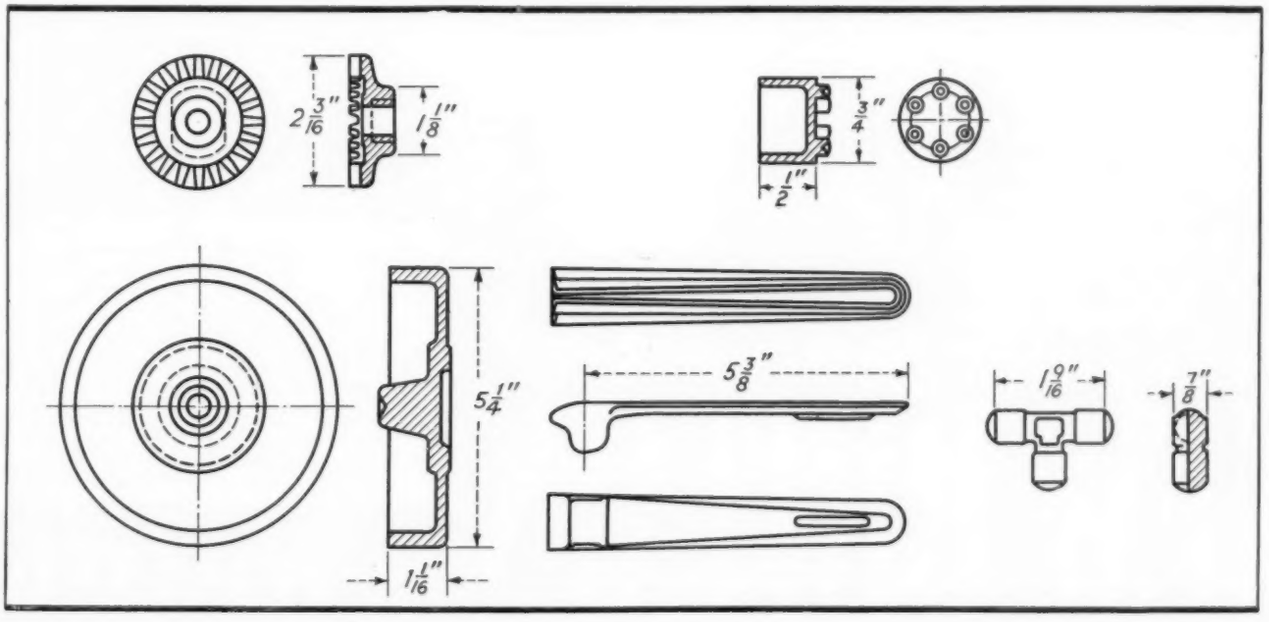
Tolerances: Tolerances on drafted parts can be held to $\pm \frac{1}{64}$ in. on small parts and $\pm \frac{1}{32}$ in. preferred on larger dimensions.

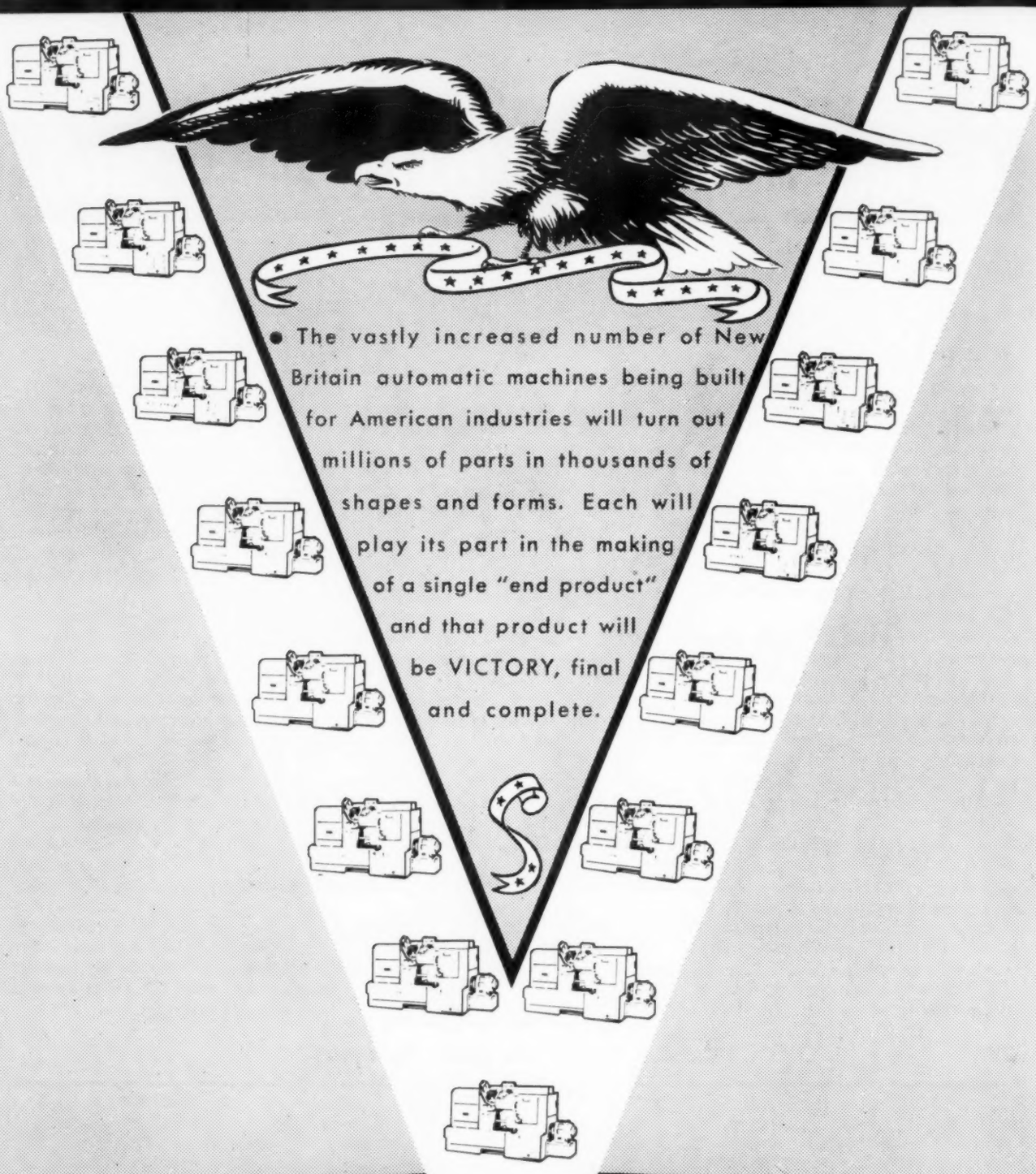
Straight diameters, parallel surfaces all within one tool or where cold sizing is possible, permit much closer tolerances to be held.

It should be borne in mind that the foregoing are general in their application to press forgings, and it is possible to take exceptions on many parts depending upon design, alloy, and other factors which directly affect the flow of metal within the dies.

The question of tolerances cannot be answered generally, but may best be summed up as follows: The tolerances which can be maintained on press forgings vary with the design and requirements of the part; however, tolerances equal to hammer forging tolerances can be maintained and in most cases bettered.

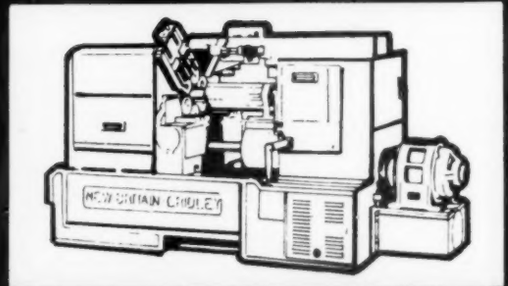
TYPICAL ALUMINUM PRESS FORGINGS





• The vastly increased number of New Britain automatic machines being built for American industries will turn out millions of parts in thousands of shapes and forms. Each will play its part in the making of a single "end product" and that product will be VICTORY, final and complete.

• New Britain builds a complete line of Screw Machines . . . up to 2¼" Capacity. Also a complete line of Chuckers . . . Four, Six and Eight Spindles up to 10¼" Capacity.



NEW BRITAIN AUTOMATICS STAY ON THE JOB

NEW BRITAIN • GRIDLEY MACHINE DIVISION • THE NEW BRITAIN MACHINE COMPANY • New Britain, Connecticut

Industrial Alert

NO LONGER are we in the position we were a short while ago, when we had a surplus of the three M's—manpower, machines and materials.

A ten-million-man army, a two-ocean navy and a fabulously large merchant marine building program ended all that. Shortages stare us in the face.

Suddenly we have been transformed from a "have" to a "have-not" nation. And that lays a tough problem in our national lap.

Every man counts, every machine counts, every ounce of materials counts. No longer can we be profligate in our use of these essentials in wartime. By sheer necessity we must be saving of our resources.

Waste is out the window and efficiency is in. A premium must be put on getting the most out of what we have.

And that brings us to what the Ordnance Department of the United States Army is doing.

It believes that the competition of war closely resembles the competition of business, in which year after year industries have had to find new materials, to conserve by redesign and to devise new methods of manufacture.

Makers of automobiles, to be specific, developed a mass market by giving attention to every part. They replaced costly materials with those less costly, reduced weight by redesigning their products and used every machine to its full capacity.

Nothing was so small that it was slighted. Everything was put under the microscope. In the competition of business every trifle became tremendous.

In the competition of war too, declares the Ordnance Department, every trifle must become tremendous. What advantage is there in possessing three times the steel production of our enemies if they make theirs go three times as far?

The way to help relieve our shortages is to make war items from less critical materials by mass production methods on less critical machines. To do that, metal-working production executives and their staffs must use initiative and ingenuity.

Take an example. A single suspension lug has been designed in pressed steel and is being mass produced on otherwise idle stamping presses. This single move made available to our armed forces thousands of bombs that were waiting for forged lugs. On one lot of 100,000 a saving was made of 17,000 pounds of steel and of 8,000 machine tool hours.

This is the sort of intelligent substitution that our army is encouraging. It wants every manufacturer working on war goods to be alert to the possibilities of making our manpower, machines and materials stretch just as far as possible.

These war days, when we wish we had more of almost everything, tremendous trifles assume tremendous importance.

Burnham Finney

GAGING BUSINESS

Plan to use existing facilities in full before making any more expansions. Changes in aircraft design require more tools. Kaiser launches ship ten days after laying keel

The war production program is being brought into better balance. Output already has been curtailed in certain items, such as shell and small arms ammunition, because manufacture is far ahead of the projected schedule. Operations in other lines are being stepped up as rapidly as possible to relieve shortages.

More and better planning of future production is discernible in Washington. The microscope is being ut on certain phases of equipment and materials procurement to make sure that everything necessary has been ordered and that unnecessary buying is eliminated. Where it is possible, plant equipment is being shifted around from one plant to another to save time and to use tools and materials to the best possible advantage.

Screening Out Orders—A definite move is on to see that all suitable existing plant facilities, including machine tools, are utilized before further new capacity is built requiring steel and other materials which could otherwise go directly into the manufacture of munitions. At the same time war orders placed for tools and for other essential equipment are being screened in an effort to sift out any unnecessary buying. It is believed, however, that bookings for machine tools are on a sounder basis than they were several months ago. There is a commendable tendency in Washington to put an end to reckless placing of orders by war contractors for equipment and materials.

Proof Required—Each branch of the Federal Government, including the armed services, is being asked to submit proof that the machines and materials asked for are indispensable. In this way it may be possible to lighten the load of tooling up for production of war goods at the proposed breathtaking pace. It is believed, however, that a relatively small percentage of the orders can thus be squeezed out. In other words, the amount of business likely to be cancelled is not so large as many people anticipated.

No Decline Expected—Never have machine tool builders had such huge back-logs as they now possess. They are operating at a close to an annual rate of $1,400,000,000 and should continue without any perceptible falling off the remainder of this year. Opinions differ about 1943. A decrease appears likely, but the volume of essential machine tools required next year is sure to be extremely large. It would not surprise many observers if it hit the $1,000,000,000-mark.

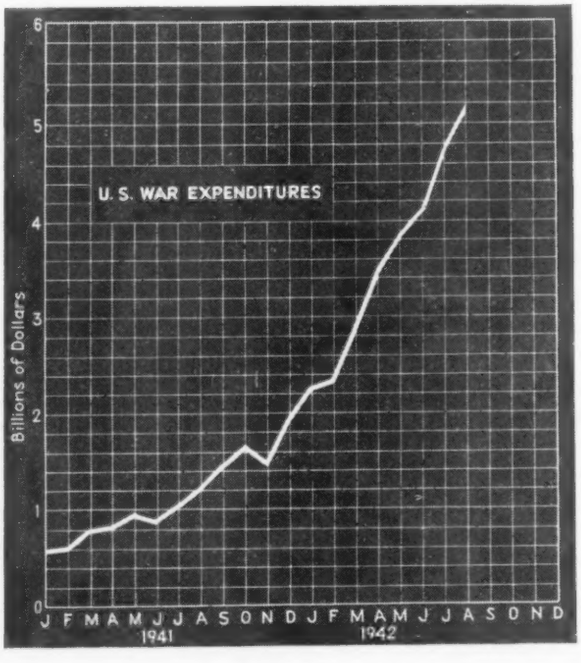
Aviation Takes Tools—The constantly shifting nature of the war necessitates frequent changes in design of weapons, from planes to guns. That means that new tooling programs and the retooling of existing facilities are likely to absorb a tremendous number of machine tools for months ahead. Current changes in aircraft and in aircraft engines, the latter representing more power per engine, illustrate the point. The aircraft industry, as the strategy of the war dictates swift changes in design and engine power and firepower, is now taking by far the largest apportionment of machine tools going to any one agency. For one thing, two new airplane engine factories are in the process of being built and many thousands of machine tools will be installed in them.

Other Influences at Work—Aside from the necessity for changing designs and improving performance of U. S. war weapons, hundreds of war contractors need more machine tools to expand present production in so-called bottleneck departments. They must watch costs too, though that factor is not so important as other factors. They are eager to get machine tools that will run automatically or with little operator help as possible, especially now that manpower is rapidly becoming a most serious problem. Over and above these considerations, new weapons, about which the public knows nothing, are being developed into the manufacturing stage. Machine tools will be needed to tool up plants to build them. In addition, Russia, Britain and other members of the United Nations are seeking large quantities of American machine tools and will take bigger percentages of the industry's output whenever Washington will let them. For these reasons it appears that machine tools for the war effort will be in undiminished demand for some time and that when the peak has passed, the production curve will rest on a high plateau.

Shipbuilding Record—Launching of a ship by Kaiser's Oregon Shipbuilding Co. ten days after the laying of the keel, with another four days for outfitting and delivery breaks Kaiser's own record of 24 days. This will not yet be standard practice—four hours earlier a "routine" ship was launched that required 43 days; but a routine launching in that length of time is well under the record time of a few months ago.

Industrial Gears—Sales in August were 38 percent above those for the same period of last year, and 10.4 percent above those for July, 1942. The eight month period, January 1 to August 31, 1942, saw an increase of gear sales of 33.1 percent over the first eight months of the preceding year, according to the American Gear Manufacturers Association. This applies to industrial gears only. It does not include automotive gears or those used in high speed turbine drives.

Rising Steadily—During August war expenditures were $5,182,000,000, an increase of 8.1 percent over the previous month. Total U. S. expenditures for war purposes since July 1, 1940, now amount to $44,741,000,000. Of this the War Department spent $23 billion, the Navy $13 billion, the Maritime Commission $1 billion, and other war agencies about $7 billion



Kanzler May Alter Production Control System

Munitions manufacture may be taken out from under PRP. Reliance on the big prime contractors for the bulk of detailed scheduling of their suppliers may follow this action.

BY ROBERT COLBORN

WASHINGTON — Ernest Kanzler's takeover of the directorship of operations at the War Production Board has fundamentally changed the probable direction of development of WPB's slowly evolving system of production control.

There will be a fight over these pending changes. Kanzler is strengthened by the appointment of his new boss, Ferdinand Eberstadt, who sees things his way. But his plans are directly contrary to the views of most of the Priority Bureau staff. Moreover, the Truman committee in Congress and much of labor will oppose his schemes once they understand them.

PRP May Lose Munitions

Immediate issue is the handling of the Production Requirements Plan; the Kanzler forces expect to take direct munitions manufacture out from under PRP, whereas the previous intention had been to have PRP cover all industry. But this is only the surface issue. Everyone now recognizes that PRP or any alternative accounting system can only be successful to the extent that the production work it is recording and controlling is realistically scheduled.

In recent months, WPB officials responsible for materials flow have come to the conclusion that scheduling of the character needed would never be achieved unless they themselves enforced it upon the armed services, perhaps did a considerable part of the work themselves (AM—Vol. 86, page 974c). The Production Requirements Plan, with its control of the input of materials into manufacturing plants, offered an enforcement mechanism.

Pre-Kanzler Plans

Important moves were taken or planned in this direction:

1. Last month's elimination of the power of Army and Navy procurement officials to issue priorities firmly gathered into WPB's hands full authority over materials.

2. The WPB Requirements Committee, preparatory to working out the fourth-quarter material allotments under PRP, demanded that the Army and Navy present it with schedules of munitions output for the quarter. In fact, the committee set a September 15 deadline—which was not met.

3. Priorities director J. A. Krug was preparing to set up an elaborate scheduling organization of his own. Organized industry by industry, it would have extended right down into the individual plants. It would have been the job of this organization to see that the rates of operation of subcontractors, of producers of parts, sub-assemblies, and semi-fabricated materials were such as to conform to the output schedules for military end-products set up by the services. WPB inspectors in the plants would have made sure that the material requests submitted under PRP matched up with these rates of production.

Rely on Prime Contractors

Kanzler's appointment upset this whole scheme. His approach to the problem is based on the belief that the Army and Navy now recognize that this country's resources are not infinite, that they will now proceed vigorously with their own scheduling job. He will promote a scheme taking all munitions work out from PRP and using instead something similar to the warrant plan which the services have been pushing for months. In addition, he will adopt the main feature of the so-called "General Motors Plan"—reliance on the big prime contractors for the bulk of the detailed scheduling.

Mechanics of the scheme are still hazy. Broadly, however, the services would present to the Requirements Committee a schedule of finished armament—probably a six-months schedule with the first month firm and the others subject to change. The Committee would modify this schedule to conform to the supply of materials and to the material requirements of essential civilian production and "shelf goods" production (nails, light bulbs, etc.) as revealed through PRP.

At this point the prime contractors producing finished armament would take over. They would assign production schedules to their suppliers corresponding to their own approved schedules. Not only would they schedule their own subcontractors but also other prime contractors producing parts rather than finished goods. Any manufacturer, then, would be permitted to buy the materials required by his approved schedule.

Amendment to Order E-1-b Affects M.T. Distribution

WASHINGTON — Amendment No. 2 makes three changes in machine tool distribution Order E-1-b.

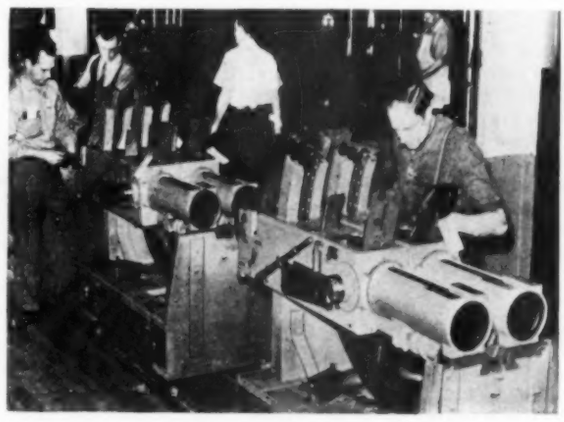
1. Whereas the 75 percent of total production to Service purchasers was divided between six groups, the amendment divides it among seven groups. They are: Navy Bureau of Ships, Navy Ordnance, Army Ordnance, Army and Navy air arms, Miscellaneous Bureaus, the Maritime Commission, and Army Signal Corps as the seventh. Quotas assigned to these groups are set up in Exhibit A, which is not made public.

2. When one group does not place enough orders to take up its quota of tools, the producer has been scheduling them to other groups. The amendment requires that the Bureau of Ships shall have first call on any Bureau of Ordnance surplus, and vice versa.

A new preference rating certificate PD-408 has been set up to cover agencies of the government other than the Service groups, such as Bureau of Mines, who want tools. This change covers only a few odds and ends.

Used Dealer Licensing

Automatic licensing of all dealers selling used machine tools or extras, or second-hand machines or parts is provided by Supplementary Order No. 20 of the OPA. Licenses will be given automatically but will be suspended or revoked for price-regulation violations.



Killer Twins — Anti-aircraft guns are manufactured in pairs for the U. S. Navy in this Chrysler plant. The 40-mm. guns are assembled on dollies

Steel Demand May be Double Current Supply
Greater Control of Distribution Is Needed

Production rates of some plants has created surplus war goods; other haven't sufficient steel for needs

WASHINGTON—Only a few facts can be pulled out of the mass of contradictions on the production and allocation of steel. One of these facts is that the 1942 "demand" is just about double our current production rate of 5,300,000 tons of finished steel per month.

Even the fact of this "demand" is questioned. Some experts doubt that the demand represents a real need. The industry is accused of past priority violations, although WPB says compliance is now good. WPB is charged with letting steel go to non-essential enterprises. The Maritime Commission is accused of hoarding plate. Any number of manufacturers are supposed to be holding high inventories. And the Army and Navy are found at fault for bad planning of procurement and plants.

Steel Statistics Doubtful

Offered as proof that the shortage is not as bad as it looks, is the assignment of about one sixth of our output to Lend-Lease and other export. Statistics on steel, like those on rubber are none too reliable at best. A WPB steel executive recently testified at the Truman Committee hearings that there is no way of telling where 12 to 15 million tons of steel go each year.

We alone are producing 88 million tons of ingots this year against 60 or 70 million tons for the Axis. Add to our tonnage the production of our allies, and it would seem we should get along, with our output increasing on a curve to nearly 100 million tons in 1943.

Trouble in Distribution

WPB is now convinced that the trouble lies as much in distribution as in production, and is resolved to tackle the problem at both ends. The Board points out that its program is out of balance because industry, after Pearl Harbor, ground up materials faster than anybody dreamed it could. Rifling gun barrels, for instance, is now done in 1/30 the time it took a few months ago. Everybody made war equipment as fast as he could. Now, it has been discovered that things should be made when needed, not before. Making things too early freezes steel and other materials that ought to be in circulation.

It is said that the Army required Ford to store 20,000 jeeps because field forces were not ready for delivery, and all that steel was immobilized.

The Board is attempting (1) to schedule scarce steel products, like shell steel, structural steel, bars, tubes, etc., just as it has been handling plate; (2) make sure that steel gets to the assembly lines in the forms wanted *when* wanted, which involves current changes in the Production Requirements Plan.

Though official WPB statements say that 75 percent of finished steel output is going into "direct war use," the fact remains that plants building tanks, ships, planes and guns have been partly down for lack of steel. Actually, the 75 percent statement is somewhat misleading. "War use" and "military use" are different. Only about one third of finished steel output is going into military, meaning weapons. War use includes railroads, machine tools, plants, steel expansion, and the like. If the Board finds that better scheduling does not solve the problem, then war uses, and the 25 percent non-war uses, will have to be trimmed some more in favor of direct military uses.

Wilson, Eberstadt Made Vice Chairmen of WPB

WASHINGTON—The appointment of Charles Wilson and Ferdinand Eberstadt to key WPB jobs, gives the top leadership of the war production program some of the aspects of a triumvirate. Nelson has been under heavy attack in recent months for the failure of WPB to solve the production-scheduling and material-flow problems characteristics of a war economy which has emerged from the tooling up stage into high gear. Criticism has not questioned Nelson's clear insight into the policy questions involved but has centered on the lagging execution of policies once decided upon.

The two appointments are obviously designed to strengthen the operational side of WPB. Both men are definitely subordinate to Nelson, but each, in his own field, will "exercise the full powers of the chairman of the War Production Board." Essentially, Nelson's own job has been split into three parts.

Charles Wilson comes from the presidency of General Electric to become "the top production authority in the war program." It will be his job to see that production schedules are met. He will be chairman of a new Production Executive Committee which will include in its membership General Somervell of Army Services of Supply, General Echols of the Air Force, Admiral Robinson of the Navy, and Admiral Vickery of the Maritime Commission.

Ferdinand Eberstadt, who has been the civilian chairman of the Army and Navy Munitions Board, will have entire responsibility for regulating the flow of raw materials. At the top level, he will control the broad allocation of raw material supplies through his chairmanship of the WPB Requirements Committee. But he will also control the detailed routing of materials within industry, since Director of Operations Kanzler, who has charge of priority matters, is required to report to him. Both Wilson and Eberstadt bear the title of vice chairman of WPB.

Fisher Body Building Two Additional Machine Tools

DETROIT—Fisher Body has started production of two additional machine tools, a new design 5-in. spindle horizontal boring machine with 40-in. horizontal traverse and 60-in. vertical traverse, and a drilling and tapping machine using radial drillheads for horizontal operations. These machines are being built by Fisher for its own use in manufacture of anti-aircraft guns and tanks. Work on several lesser projects of similar nature is also being done by the former body builder.

New Vice Chairmen for War Production Board

CHARLES WILSON

Harris & Ewing

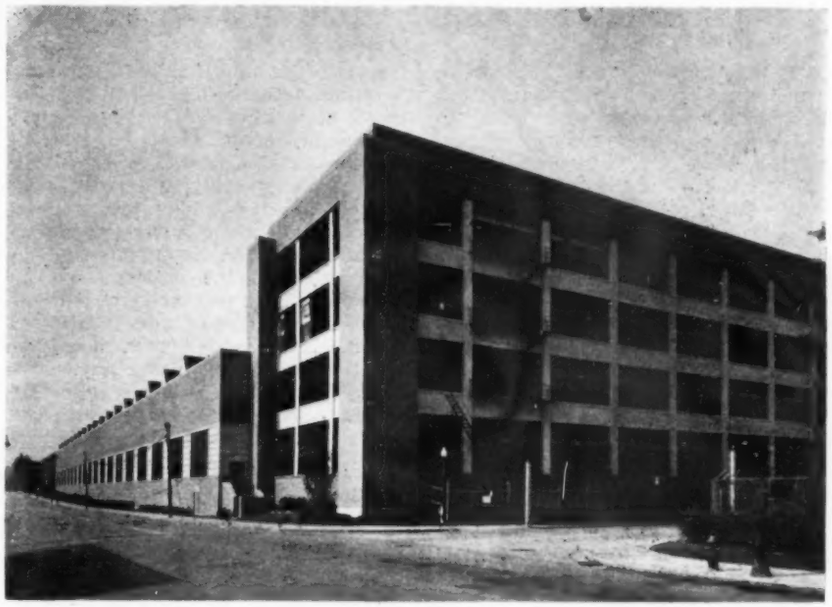
FERDINAND EBERSTADT

Cincinnati Milling Completes Plant Additions

CINCINNATI—The Cincinnati Milling Machine Co. played host to a group of business paper editors on September 22. The occasion was the completion of plant additions and the opportunity of viewing the company's full activity in war production.

The guests were welcomed by Frederick V. Geier, the company's president, and Charles M. Reesey, manager of Technical and Service Publications Dept. Mr. Geier outlined the growth of the organization and described its contribution to the war effort.

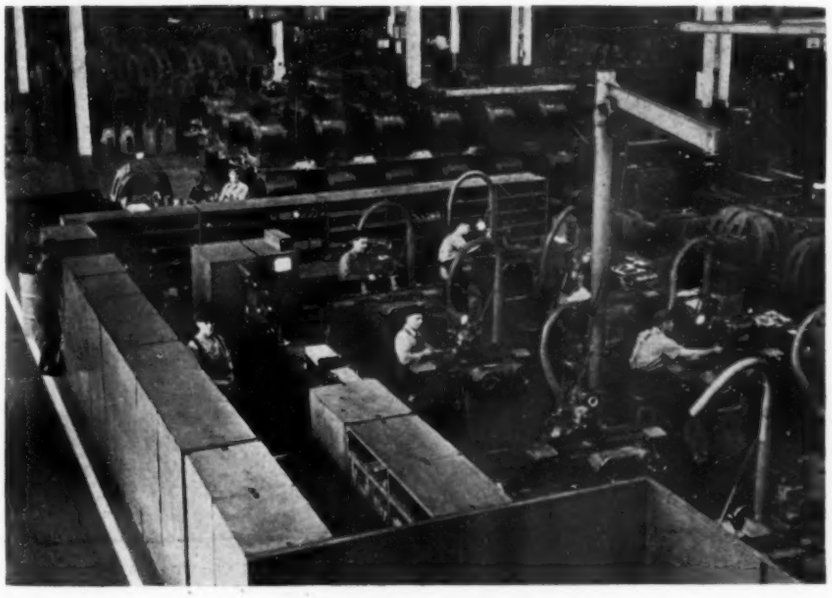
The morning was spent in inspecting plant No. 1, including its training school, medical department and manufacturing facilities. In the afternoon the editors were guided through the new foundry, plant No. 2 and an exhibit of the use of Cincinnati Milling, Grinding and Broaching machines on war material. A question and answer session was followed by dinner at the Cincinnati Country Club.



Manufacturing and research departments now occupy the four-story building (above) in the foreground formerly used for the pattern shop and pattern storage. The new one-story structure to the left closed the space between this building and the original plant No. 1 in the distance. Now the entire block is shop area

Dr. E. C. Binstadt treats a patient in one of Cincinnati's five medical departments (above). No point in the plant is greater than 1,500 ft. away from one of these departments. A nurse, doctor, or both are in constant attendance whenever anyone is within working range; which means 24 hours a day seven days a week in most cases

Tool grinding areas (right) are spotted through the manufacturing departments to make them readily accessible to all operators. Here is one of those in plant No. 1. Expert handling of sintered carbide tools has made these areas all-important



Canada Cutting Civilian Industry to Meet Manpower Shortage; Each Industry to Plan

OTTAWA—Major current concern in Canadian war economy is curtailment of civilian industry to meet an acute manpower shortage. Heading a new curtailment setup are Chairman Donald Gordon of Wartime Prices and Trade Board (price control) and Director Elliott Little of National Selective Service (manpower). Gordon has created a new industry curtailment division of WPTB under the immediate direction of Robert Chisholm, successful Toronto business engineer who has functioned since December as administrator of wholesale trade in the price control administration. WPTB and Selective Service are tied in by an intercontrol committee in which the production and supplies division of Munitions and Supply Department and controllers of hydro electric power, transport and other services are represented.

Industrial Group Plans

The overall pattern provides for allowing industrial groups to draw their own contraction and adjustment plans as far as they are able and willing do do so. Each group will appoint a committee to work with a WPTB administrator in determining to what extent the industry can curtail for the release of manpower and how the curtailment is to be distributed. Little will tell the committees how much manpower he requires from each industry. If a committee draws a curtailment plan that meets Little's needs it will be formalized in a WPTB order and the administrator will be given enforcement powers to see that it is carried out.

The example was set in the newsprint industry where a curtailment plan for the release of electric power for war plants was formulated by the newsprint administrator in consultation with the industry itself. The plan took into account the release of manpower in districts where it was needed for war production.

While curtailment will be distributed with a view not only to the release of workers in areas where they can be absorbed into war industry but also to the availability of the displaced plants for war work, the outlook for war work for a large percentage of the displaced and curtailed plants is far from bright. Shortages of both machines and materials stand in the way.

Supply of machine tools from the United States has slowed up, with the result that the spreading out of war work to displaced civilian plants is being increasingly restricted to those that already have equipment that can be employed on war output. Plants without suitable equipment are going to be out of luck. Many plants are equipped to do war work in lines in which there is a surplus of output already, such as in sheet metals.

Firms May Pool Losses

In this situation, Ottawa is turning slowly and so far very tentatively to the question of compensation for displaced industry. It is such a staggering question that it will probably not be grappled with seriously for a good while. Curtailment and displacement is not confined to manufacturing and processing industry. Price ceilings and shortages of consumer goods are forcing many units of the distribution trades out of business. They are held to be as much entitled to consideration as manufacturing plants shut down because war production requires their electric power or their workers. On the other hand it is recognized that a business concern subjected to loss by war economy policies is as deserving of protection as those exposed to loss through bombing or other enemy action, which protection is already provided.

The newsprint industry, in conjunction with the administrator, has worked out its own plan of compensation. No government assistance is involved, the plan being designed to distribute loss due to market shrinkage as well as to enforced contraction for the release of electric power. Under this plan a money pool is being set up into which units that continue in profitable production will pay part of their profits and out of which units displaced or curtailed will be compensated. Including the drying of sulphite on newsprint machines, the average of production in the industry is now around 75 percent of capacity. Mills which are allowed to produce above this average will pay into the pool the cash or profit value of production in excess of 75 percent of capacity and those closed down or curtailed will receive from the pool the cash value of the volume of production by which they are reduced below 75 percent.

U. S. Action Watched

Other industrial groups may seek to distribute curtailment losses in some such manner but the losses for some are likely to be beyond their capacity to sustain. In the meantime, Ottawa officials and Canadian businessmen are watching for indications of what the United States may do in this connection.

Canadian priority officials continue operating under PRP without seeking to make interim adjustments to Washington's juggling operations with it. There is, for example, no move here to remove direct munitions production from PRP control such as the Kanzler forces are reported to be aiming at in Washington. Canadian contractors are being advised to get their PRP papers for the first quarter of 1943 in by the end of October. Ottawa officials recognize, however, that the trend is towards the adoption of an allocations system in place of rigid priorities and they favor it.

WE'RE FIGHTING "FOR KEEPS"

WASHINGTON—War production in the United States has increased 3½ times since Pearl Harbor, but that is not good enough, Donald M. Nelson told a Labor-Management Drive Rally, of RCA-Victor, on September 13. In this game there is no second price, Nelson said. We are playing for keeps. The United States is engaged in a fight to the death against the Axis. We have no place in Japan's "co-prosperity Sphere", nor in Hitler's "new order". For us they mean economic, political, religious and personal slavery.

Scrap Ingenuity — This machine, built from scrap materials by the New York Power & Light Corp., is used for salvage of other items. A bucketful of copper connectors is shown being poured into the drum which contains a cleaning solution of kerosene and buckshot. Bolts and nuts are also salvaged in this manner

INSIDE DETROIT

President inspects Detroit war plants. Output per wage earner up 12 percent in three months. G. M. workers get wage increase from WLB, women will get same pay as men

BY RUPERT LE GRAND, DETROIT EDITOR

DETROIT—With utmost secrecy attending his visit, the President recently inspected major war plants in this area. Arrangements for plant visits were made exclusively with the managements involved. When the "Big Man", as he is alluded to here, departed on the balance of a swing through arms centers, the purposes and results of his Detroit stop-over were kept strictly confidential.

Since defense became the important business of the nation, this is the first time the Chief Executive has visited the headquarters of an industry charged with the production of one-sixth of armament production. What he saw were the spectacular undertakings of the major plants. It is doubtful that any living man could accurately appraise the entire current effort, which is now equivalent to the production of 6 million cars per year.

And as it learns new tasks, the automotive industry is becoming more efficient in arms production. For 133 auto companies, representing 68 percent of the industry on an employment basis, the shipments per wage earner advanced 12 percent in the three-month period from May through July. In actual dollar value, these shipments per wage earner were: May, $790; June, $858; July, $894. At peak war production, the estimated shipments per wage earner will be $1,311.

Increase in Value Added

The term "value added" is not entirely conclusive because there are duplications of various sorts in figures reported for compilation of an overall picture of the industry. But in considering value added per productive wage earner, two significant points stand out. First, the value added per production worker made a 22 percent jump in the May-July period, or from $575 to $702 per individual. Second, the labor cost in percent of value added declined from 55.7 to 33.1 percent. And during the June-August period, the 133 companies employing 68 percent of industry workers showed a gain in employment from 384,153 to 428,606. In August, the employment gain for the Detroit region amounted to approximately 5 percent.

With 153,000 additional war workers required by Detroit-region plants before the end of the year, and at least 50,000 men scheduled to be drafted from war plants, government officials are concerned by the slow rise in employment of women. A recent survey showed that 180,000 women, 53,000 of whom have had factory experience, are willing to leave their homes for war plants. As of August, women on the payrolls of the 133 auto companies totalled fewer than 10 percent. As a consequence, D. J. Hutchins, regional head of the WPB, has asked all war plants to make immediate preparations to hire women in larger numbers, and to create the proper facilities for them, because the available supply of manpower will become practically nil in a few weeks time.

General Motors Pay Decision

Without explaining its reasons for doing so, the War Labor Board handed G. M. workers a four-cent increase. Originally a WLB panel had recommended five cents—1.5 cents to cover the spread between wage increases of 13.4 percent since Jan. 1941 and the 15 percent cost of living increase formula under the "Little Steel" decision, plus 3.5 cents to narrow the differential between G. M. and Ford.

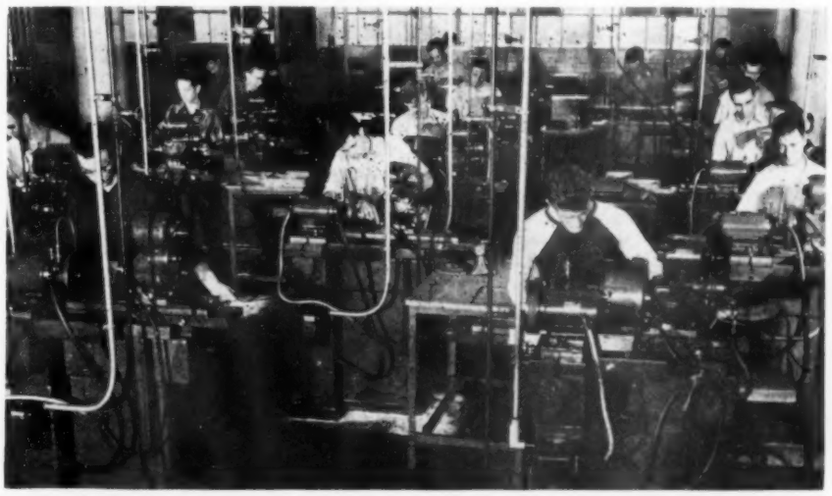
Since the interim wage agreement (pay for lunch, etc.) was not cancelled, and two weeks vacation allowance was granted to workers with five years seniority, the **actual** increase per worker amounts to practically eight cents per hour. G. M. did not contest the union's demand that women get the same pay as men for equal work.

Prompt WLB decisions in respect to the Chrysler and Ford cases are expected so that their workers will be able to get on the gravy train before Congress can be induced to crack down with a wage ceiling.

The decision of the Board affronts the intelligence of the American people. Everyone knows that the average weekly earnings of auto workers have soared far above the comparable increase in cost of living. With the latest increase, G. M. workers will earn approximately 40 percent more per week (instead of 32 percent) than they did during the January, 1941 base period which the Labor Board uses when talking about a 15 percent rise in the cost of living, as of May this year. The

BRITISH PURCHASING CHANGE

DETROIT—The British Ministry of Supply is greatly expanding its offices in the General Motors Building, in a move which presumably parallels the recent establishment of the Combat-Automotive Center here by the Ordnance Branch of the U. S. Army. Although details of the British setup are not available until the director returns from abroad, it is obvious that transfer of an important sector of activities by the British from Washington to Detroit is predicated upon a desire to establish closer relationships with contractors in this area with respect to the design, procurement, inspection and supply of munitions.



Precision Grinding—Accuracy down to ten-thousandths of an inch is maintained in these finely-adjusted grinding machines in the Ternstedt plant of the Fisher Body Division. The plant is engaged in aircraft instrument manufacture, and grinding is one of the most important preliminary operations in this work

effect of its decision is that G. M. workers, and soon other auto plant workers, will be earning more than the $54.20 weekly average reported for August by 133 auto companies.

Of a piece with the G. M. decision, the War Labor Board has taken upon itself to promulgate a "settlement" of the G. M., Ford, Chrysler and Automotive Parts & Equipment Manufacturers cases with respect to establishment of wage rates and wage differentials for the tool and die industry. The projected conference of management, labor and government in Detroit on Sept. 21 fell through when the manufacturers showed that pirating of labor has been of no consequence, despite differentials in wages paid by corporation and independent tool shops. To rub it in, WLB also indicated that it would hand down a decision concerning wages for skilled maintenance workers, which had not previously been represented in the controversy.

WAR RULINGS IN BRIEF

Checklist of Significant Regulations on Materials and Prices

CORUNDUM—Control is extended to supplies in the hands of consumers; new reporting procedures for supplies and consumers, and for consumers' applications for authorization to receive supplies, are set up. (Amendment 1, General Preference Order M-89.)

CRANES — Overhead traveling cranes have been subjected to direct production supervision and allocation. Schedules shall be maintained without regard to any preference rating assigned to particular purchase orders, except by specific direction of the Director General for Operations. (General Preference Order M-225.)

CRYOLITE — Complete allocation and control is established. (Part 2021, General Preference Order M-198.)

CUTTING TOOLS—The War Shipping Administration has been added to the agencies for which exceptions to certain provisions are made. (Amendment 1, General Preference Order E-2-b.)

ELECTRONIC DEVICES — No one may fabricate, assemble or produce in excess of a minimum inventory required to meet deliveries on orders rated A-3 or higher. Inventories are permitted up to a 45-day supply, but not to exceed 12½ percent of total 1941 sales. (Limitation Order L-183.)

INSTRUMENTS — New equipment using chromium, nickel or their alloys may be delivered only on rating of A-1-c; the required rating for deliveries of repair and maintenance supplies has been changed from A-10 to A-8 or higher, except on equipment needed by certain agencies. (Amendment 1, Limitation Order L-134.)

IRON AND STEEL — Maximum prices for rejected flat-rolled and semi-finished iron and steel products have been established by the OPA at levels ranging from 65 to 85 percent of the base prices for comparable products of prime quality, plus a percentage of a limited number of trade extras. (Amendment 7, Revised Schedule 6, Iron and Steel Products.)

MACHINE TOOLS—Distribution is allocated by quotas, 75 percent of each producer's monthly production being set aside for Army, Navy and Maritime Commission Contractors. Each of these groups are subdivided and assigned a quota. Should any group not take all of its quota, said surplus will be available to the next higher rated group, or failing demand, to the next lower. Machine tools may be rated by a Preference Rating Certificate of the PD-407 series. (Amendment 2, General Preference Order E-1-b.)

OIL PRODUCTION—A-1-a and A-2 preference ratings have been assigned to deliveries of all materials used in the production branch of the oil industry and those used for maintenance and repair purposes or as operating supplies in other branches of the industry. (Section 1041.2 Preference Rating Order P98b.)

STEEL CASTINGS—The definition has been changed to make it clear that it covers both rough and machined castings. (Amendment 3, Revised Price Schedule 41.)

STEEL DRUMS—After October 1, the letter "X" is required to be embossed on the bottom plates of new steel drums. The use of new or second hand steel shipping drums for packing approximately 200 food, chemical and petroleum products after November 13, has been prohibited. Effective immediately, the order prohibits packing of any product of an additional list of approximately 35 items in a new or used drum manufactured, purchased or delivered after September 14. The order forbids use by any person of new or used drums for packing products which he has not packed in drums prior to the issuance of this order. (WPB Limitation Order L-197 and Amendment 1, thereto.)

TURBO BLOWERS — Production and distribution of a wider range of turbo-blowers is covered. (Amendment 1, Limitation Order 1-163.)

Production Achievements

In a report to stockholders, Chrysler states that the production of Bofors anti-aircraft cannon was started substantially in February in two figures, that by July output had increased 30-fold, with August showing an even further rise. In essence, the achievement is that of attaining interchangeable manufacture on a mass-production basis for a foreign weapon containing 5,472 individual parts. To get the best results from the combined resources of the corporation, manufacturing operations were split into five major sections and several minor ones, with the DeSoto, Dodge, Plymouth, Highland Park and Chrysler plants all taking approximately an equal share. An indication of progress made is the fact that assembly of the Bofors abroad takes 450 hours per gun, while interchangeable manufacture has reduced the assembly time at a Chrysler plant to fourteen hours. One of the most interesting operations in the final assembly department is that of placing the completed gun in a machine which tests all of the weapon's functions mechanically before it is shipped to the firing range.

In the field of delicate aircraft instruments, the Ternstedt Division of Fisher Body is in production three months ahead of schedule. "When the job was undertaken," reports E. F. Fisher, general manager of Fisher Body, "we had only some floorspace and four walls. We assigned it to a section of a plant formerly devoted to body hardware, and even had to install a hospital, plumbing, airconditioning, and office and laboratory, as well as all production equipment. Not a single piece of equipment was on hand within our organization. Using drawings made available by Sperry (for gyro horizon and directional gyro indicators) we had to build our own fixtures and much of the equipment."

Numerous women and watchmakers have been employed on the instrument job. Production requirements involve precision machining to extremely close tolerances, perfect polishing of tiny moving parts, perfect balance, utmost cleanliness which is secured with filtered air and special lint-free garments worn by employees. One tiny assembly in these instruments contains five minute ball bearings, each of which weighs 15/100,000ths of an ounce, and three thousand of them fit comfortably into a thimble.

WARTIME WASHINGTON

New ships harder for submarines to hit, sinkings fewer. Aircraft builders consider including other products after war. Important new bomber is coming off production lines

BY BLAINE STUBBLEFIELD

WASHINGTON—Sinkings of new ships, Liberty and the more elaborate "C" types, are much fewer than sinkings of older boats. The new craft are faster and harder for the submarines to hit. They have welded seams which don't spring like the older riveted lap. New ships are better compartmentized. Some of them have been able to make port with two direct torpedo hits. One tanker was cut cleanly in two, and both parts were towed in and put together again. All merchant ships are armed now, but the new Maritime Commission ships have built-in armor, which makes their crews more willing and able to fight, and the U commanders know it.

1299 ships of all kinds were built by the Shipping Board during the three ship-production years of the First World War, 1917-18-19. By the end of 1943, the Maritime Commission program will have turned out 2300 merchant vessels, plus 700 smaller craft. This means that we will build 2½ times as many ships in a two-year period in this war as we built in the World War three-year period. The two main reasons for this improvement are welding instead of riveting, and the new quick assembly of subassemblies, which gives men and tools room to work.

Preparing for Future

Designers are being shifted around, notably in the plants of major aircraft manufacturers, and allowed to make drawings of all kinds of metal-work peace merchandise. Though such work does consume a few man-hours, management cannot resist the temptation to make some preparation for the future. And no harm is done, when you consider that the aircraft industry could turn out 35% more products if it had a full flow of materials.

It's an old story—the building of ships, guns, and even tanks, though brand new technologies are being worked out in these lines. But it is safe to say that the tense aircraft design and production war is bringing out more new tools and machine processes, and more new metallurgy, than any other line of weapon manufacture. Thus the aircraft men feel that, when the stoporders finally come, they will be ready to turn to a wide variety of metal products.

At least one major airplane manufacturer has been drawing pictures of automobiles he might make, with several new departures in design. At least one other has gone into chemistry and the thousand-and-one synthetic products he might make. Not only the aircraft people, but many "convertible" industries will be back at the starting line. In many cases established "acceptance" will have been lost and old concerns will find themselves matching wits against newcomers with new ideas.

Question will arise, one day, whether this country is to remain an arsenal for itself and much of the world. Many hope but few believe that this war will bring perpetual peace. If we stay armed, ordnance, aircraft and ship plants will have to be held in semi-readiness to produce weapons again.

New Bomber Built

An important bomber, just now coming off the lines, will go to the battle front without a word of description, or even the mention of its number and name. This machine, judging from what the editors know about it, will bring more trouble to the enemy than even the Flying Fortress. The manufacturer has been told he can say nothing at all until Hitler gets one or more of the new craft. That may be quite a while, for best information indicates it was months before he got a Fortress. He is believed here to have only two to date. There is no record that the Japs have *any* so far. This means, among other things, that public controversy over performance of aircraft is quite useless, since laymen, congressmen, even expert critics, will not know, literally, what they are talking about. Not only this bomber, but other planes in all categories are in all stages of development, from drawing board to delivery for the front.

Steelman—Hiland G. Batcheller, president of the Allegheny-Ludlum Steel Corp., has been appointed head of the WPB Iron and Steel Branch to replace Reese H. Taylor who resigned on August 31. Mr. Batcheller served as a consultant in the priorities division of OPM last year

Regional Manpower Offices

Five months after the creation of the War Manpower Commission, Chairman McNutt is just getting around to setting up his regional offices. Four appointments last month of regional directors leave four of the twelve posts still unfilled. These regional offices and the area offices under them will carry the bulk of the real work of the commission—when it gets to work—and McNutt is being criticized in Washington for his dilatoriness. Some of the President's closest friends are particularly angered that he should embarrass FDR by raising before the elections the touchy issue of labor-draft legislation as he did at the American Legion convention. There's little disposition to question the eventual need of a national service law, but it's thought that McNutt had no call to talk about compulsion when he had not yet given voluntary methods a nominal trial.

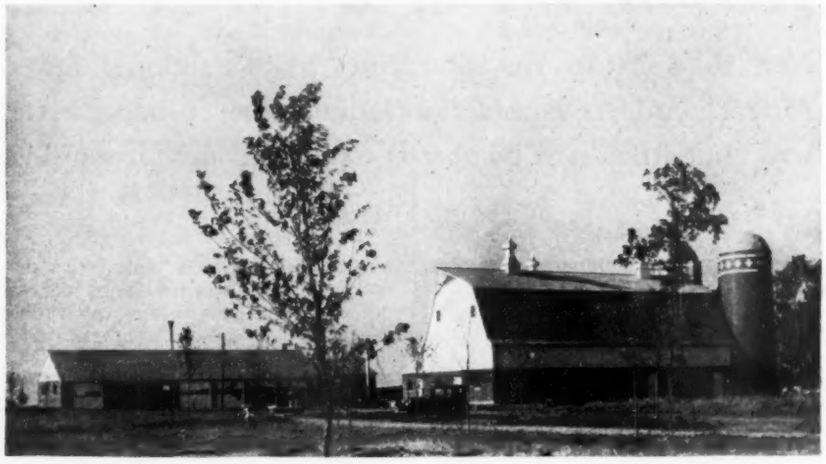
The pressure behind compulsory labor allocation is increasing as the immense demand of the armed forces for men becomes clear. It now looks as if 13 million men might be in uniform by 1944. Balance this against the fact that of the 27,500,000 odd men between 18 and 45 only about 13,500,000 can pass an army physical exam. With the cream of the working force removed, there will have to be the utmost economy in using the rest.

WAR TAKES MOST OF STEEL

WASHINGTON — More than 75 percent of the nation's steel output of 5,300,000 tons a month is now going into direct war use, the remainder into essential industries as railroads, machinery manufacture, etc., according to the Iron and Steel Branch, WPB. 80 percent is being delivered on ratings of A-1-a or higher. The steel industry is operating at more than 97 percent of capacity; has been over 90 percent for two years.

Converted Dairy Yields "Harvest for Hitler"

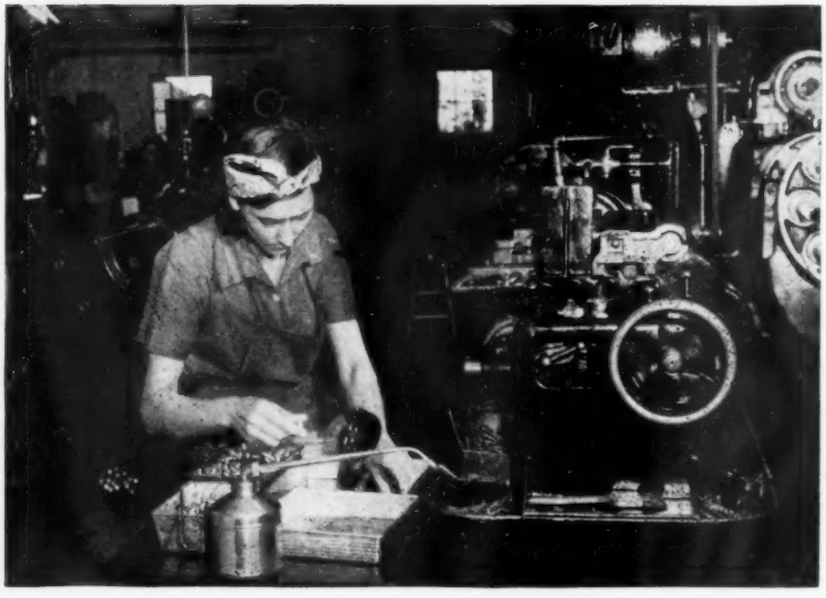
Plowshares to Swords—There'll be no cows on this Iowa dairy farm until after the war. These modern dairy buildings have been converted into a shell production plant with machine tools operating in the machine shed and in the barn. A little over a year ago Ed Sundholm found he was getting more contracts for war work than his over-crowded shop could handle, so he converted his dairy farm—then nearing completion—into a shell factory



Official OWI Photos by Palmer

Operators—The machinist who consults his foreman (left) and the woman operating the screw machine (below) are part of the working force that now keeps the plant running on a three-shift basis. When peak production is reached about 150 workers will be required. Of those now employed 35 are women. Every inspector is a woman and an increasing number are being trained in machine operation

Chief—Ed Sundholm (below), president of the Superior Manufacturing Co., and owner of the dairy-factory is a veteran of World War I. He is amused to think of what would happen should a footloose cow happen to wander into what is now a modern shell-producing factory



LINES ON AIRCRAFT

Helicopter business will be greatly increased in the next decade, Sikorsky predicts. What Kaiser didn't get. Our only deficiency in warplanes has been in fighter craft

Helicopter business, including parts and services, will be one billion dollars annually within ten years after this war, says Igor Sikorsky, engineering manager for United Aircraft's Vought-Sikorsky division. Mr. Sikorsky told AMERICAN MACHINIST that his first output, when peace comes, would be expensive, but that eventually he can bring the price down to that of a medium car.

About 600,000 or 700,000 units per year is the rate Sikorsky expects to distribute at that price, allowing for services and parts out of the billion dollars. He made his predictions in the September issue of Atlantic Monthly, describing how housewives will fly his direct lift craft safely, and how helio-buses carrying up to 20 passengers will pick commuters off their front lawns.

Future long range aviation, over 200 miles, he leaves to conventional fixed-wing airplanes. Helicopter speeds he expects will get up to 140 m.p.h. He started experimentation on vertical lift some 30 years ago. Meanwhile many other developments have succeeded in getting off the ground, here and abroad. Sikorsky's VS-300 has been demonstrating for a year or so. It is now a military secret.

Helicopters lift themselves vertically with a horizontal propeller geared to the engine. They have few parts and lend themselves well to assembly line production, and can be made of various materials, including economical seamless steel tubing.

What Kaiser got wasn't what he wanted. He wanted to mass-produce existing cargo plane designs by pulling together several large aircraft manufacturing capacity, just as he pulled six companies together to build Boulder Dam. He assumed that the war chiefs wanted a huge cargo fleet, but he assumed too much; they don't. They are afraid to risk trying air cargo to replace surface cargo extensively at this stage of the war, and besides, our total aircraft production is already 30 percent cargo—with China, Britain, Russia, Australia and our Army and Navy all needing combat planes.

Actually, Kaiser was no more eligible for an airplane contract than hundreds of other war contractors. He got it by sheer bulldozing and persistence. But his order for three planes, mostly plywood, will take little strategic material. And the design is probably a perfectly sound job by Howard Hughes' organization.

It's an ocean freighter, with two hulls for stability on the water, and seven engines, three of them between the hulls and two on each wing. Gross weight 140 tons; cargo around 60 tons; engines and instruments will be made available by War and Navy. First plane, will be completed in 15 months, will be statically broken down, and the second and third, to be delivered in 20 and 25 months, will be test flown.

If the war lasts long enough, and if it demands a super fleet of cargo planes, the Kaiser-Hughes design might be mass-produced. Of course Kaiser's design and plans may change radically.

Only the experts know what the airplane performance controversy is all about—and most of them are prejudiced one way or another. You will never know enough facts to argue it, if you're just a part-time observer. But here is the formula for judging what you read: All airplanes are compromises. They can carry heavy armor, heavy guns, lots of ammunition, bullet-proof tanks, heavy radios—all for the crews protection—and lack speed, altitude, and maneuverability. Or, they can unload part or most of the above, and have performance. They can't have all of these. Main question is: Do our planes win, and the answer is that they do.

We are deficient in fighters only. Our P-40s and P-39, both do beautiful work at low altitude, but our high-level fighters are just getting into production. Main three of these are P-38, P-47, and Navy's F4U-1. Reason we are late with high-level fighters is because Army started late to develop high-power liquid-cooled engines. The Allison, our only liquid-cooler, is now only 1350 hp., compared with over 2,000 top in air-coolers. The P-47 and the F4U-1, designed to outfight anything else in the world, are both air-cool powered at 2,000 hp. (The P-38 is a performer because it has two Allisons.) You might argue, justifiably, that we shouldn't have wasted any time at all on liquid-cooled engines.

Our heavy bombers, with long range, altitude, and speed, which cuts their bomb load, were designed to defend this hemisphere, not to fight on the short ranges of Europe. There, however, because of their high ceiling and maneuverability, they are doing a fine job of day bombing. In all other categories: transport, dive bombers, medium bombers, patrol and torpedo planes, we excel or equal all foreign combat airplanes.

A Stack of "Blues"—Chips to play against the Axis pour into car enroute to smelter, as final step in "chip-handling" system developed by Wright Aeronautical Corp.

Lodge & Shipley Too Busy For 50th Year Celebration

CINCINNATI—The golden jubilee of the Lodge & Shipley Machine Tool Co. will be celebrated with "war production as usual," William Lodge Dolle, grandson of the founder and now president and general manager, has announced.

Since its founding in 1897, the firm has expanded steadily. Before the United States declared war on the Axis powers, Lodge & Shipley had been supplying the other United Nations, principally Great Britain, with lathes for war purposes.

After Pearl Harbor, the company further stepped up its production and started on a 24-hour operation schedule. Last March, it was awarded the Navy "E" for production achievement. In April, the company acquired a group of industrial properties suitable for manufacturing and began further expansion. The original Lodge & Shipley personnel with a few artisans and machinists has grown to approximately 1,100 employees.

Too busy to engage in any celebration, the officials of the company are foregoing any public observance of the fiftieth anniversary. A jubilee book is being published for distribution to employees and to the trade.

Army-Navy Production Award Presented to Additional Plants; More Winners Listed

WASHINGTON—The laudatory "E" of the Army and Navy was awarded this week to 27 more industrial plants, proclaiming to all and sundry that the employees and officers therein have worked well and efficiently in furthering their part of our war production effort. Similarly, the "M" of the Maritime Commission was awarded to an additional ten deserving plants. Pictured on these pages are scenes from several of the ceremonies held recently. Those winners announced since the publication of previous lists (AM—Vol. 86, pages 916d, 974d, and 1042d) are:

American Brake Shoe & Foundry Co. (Upset plant), American Rolling Mill Co. (Zanesville, Butler, Hamilton, Ashland plants, East and Central Wks.), American Smelting & Refining Co. (Hayden branch), American Zinc Co. (Monsanto plant).

Boeing Airplane Co. (Wichita Div.), Budd Wheel Co., Burgess-Norton Mfg. Co., Continental Roll & Steel Foundry (East Chicago plant), Duiron Co., E. I. du Pont de Nemours, Inc. (Neoprene plant).

Electro-Metallurgical Co., General Motors Corp. (Packard Electric Div.), Goodyear Engineering Corp. (Hoosier Ordnance plant).

Hayes Industries, Hobart Brothers Co., Homelite Corp., International Smelting & Refining Co. (Miami plant), Kennecott Copper Corp., Mount Vernon Die Casting Corp., National Carbon Co. (Clarksburg plant), National Wire Die Co.

Specialty Screw Machine Products Co., Vanadium Corp. of America, Wallace Barnes Co. (Div. of Associated Spring Corp.), Waverly Tool Co., T. H. Wood Co., Inc., N. A. Woodworth Co.

The Maritime Commission has awarded "M" flags to several manufacturing plants and shipyards. They include Bethlehem-Fairfield Shipyard, Inc., Oregon Shipbuilding Corp., Richmond Shipbuilding Corp. (Richmond Yard No. 2); Enterprise Wheel & Car Corp., Erie Forge Co., Isaacson Iron Works, Marion Steam Shovel Co., Western-Walker Co., Wickwire Spencer Steel Co. (Palmer plant), Wilson-Snyder Mfg. Div.

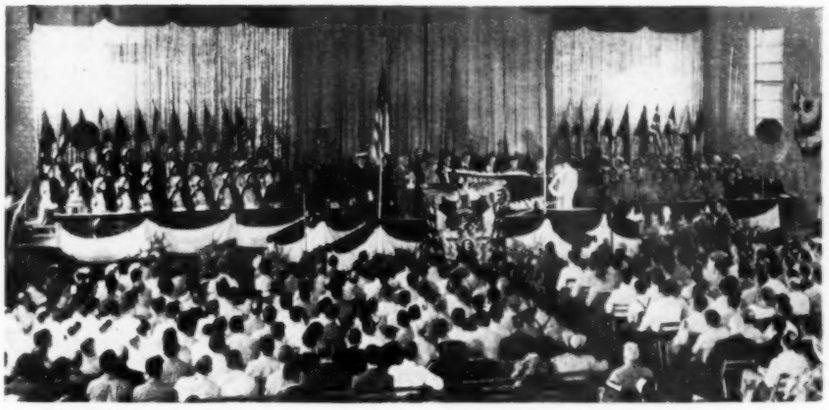
AXELSON MANUFACTURING CO. received the award in its fiftieth year. G. A. Axelson, chairman of the board, said, "In accepting the Army-Navy production flag for high achievement in the production of war equipment, we of Axelson pledge ourselves to greater effort and say to the men of our armed forces, 'Your battle is our battle'"

WILLIAM SELLERS & CO. is aiding the Navy and the Army in the fourth war since the firm started building machine tools in 1848, Comm. J. F. Cleary pointed out to employees. Sellers tools helped build the Civil War Monitor. Holding the pennant are Maj. R. G. Allen, Comm. Cleary, Sellers President Eugene C. Clarke, and Employees Shop Committee Chairman Carl L. Wright

GREENLEE BROS. & CO. heard Lt. Col. Edward H. Bowman say, in presenting the pennant to President George C. Purdy, that "The Army Air Force congratulates the management and the workers for your excellency in workmanship on the critical machines you are manufacturing, for your skillful management, plant protection, and your high labor standards"

GISHOLT MACHINE CO. heard president George H. Johnson (second from left) say "Our record of achievement has only been possible because of the hard work, and cooperation of every member of our organization." Displaying the flag are Brig. Gen. N. F. Ramsey, president Johnson, Gisholt, CIO Union president Clifford H. Johnson, and Lt. Comm. E. H. Schubert

THE FOSDICK MACHINE TOOL CO. was told by R. Eugene King, president, that the pennant "proclaims our never-ending conviction that free men, living and working under the American system of free enterprise, can and will produce more . . . than will all regimented industry and enslaved labor that any combination of dictator-ruled nations can marshal against us"



CARLTON MACHINE TOOL CO. workers heard President Jack Carlton say that "It still takes good men to do good work." Holding the pennant are Mr. Carlton; John Keller, John Ploeger, Albert Spangenberg, Frank Hoesl, and Secretary William Dermody. Keller, Ploeger and Hoesl are the three oldest Carlton workers in point of service

BAUSCH & LOMB OPTICAL CO. received the joint award after having twice received the Navy "E." At the broadcast are Capt. Henry T. Markland, President Herbert Eisenhart, Employee's Representative Michael J. Smith, and Col. Frank J. Atwood. Both Eisenhart and Smith pledged increasing efforts to keep the armed forces supplied with needed optical equipment

DuPont Explosive Rivets Used for Repairs at Front

WASHINGTON—Explosive or "blind head" rivets, which can be set by one man from one side of the work, are now used at the front to make airplane repairs in a few hours which formerly required days. This announcement is made by E. I. DuPont, of Delaware.

Explosive rivets, which contain a charge in a cavity at the end of the shank, were first put into use in aircraft construction a year ago, substantially speeding production.

Heat, applied to the rivet head with an electric gun, detonates the charge, expands the shank, setting the rivet. They can be installed by one man at the rate of about 15 to 20 per minute. DuPont says that millions of explosive rivets have been used at inaccessible fastening points.

Speedy repair of damaged wings and other parts of airplanes at the front is equivalent to additional equipment.

Twelve Fuel-Saving Rules Help Maintain Conservation

MINNEAPOLIS—Engineers of the Minneapolis-Honeywell Regulator Co. have developed twelve ways in which industrial plants can save fuel, and actual tests show that savings as high as 30 percent have resulted where these rules have been applied. These conservation rules are:

1. Maintain the minimum permissible temperature in each section of an industrial building.
2. Maintain even temperatures in all occupied spaces and take frequent readings or recordings to be certain that these temperatures are being maintained.
3. Turn off the heat in unoccupied spaces or reduce the temperature to just above 32 deg. where freezing would cause damage.
4. Disconnect unused lines and radiation.
5. Reduce temperatures at least 10 deg. when space is not being used, such as at night.
6. Use ventilating fans only when absolutely necessary and reduce the amount of outside air taken in to a practical minimum.
7. Insulate all doors and windows and keep them closed except to maintain a minimum of ventilation required for the workers' comfort.
8. Remove anything which shields radiators, such as machines and cabinets, so that there will be no retarding of the flow of heat.
9. Have a competent heating engineer make a complete survey of the heating system and make any changes he recommends.
10. Employ a competent maintenance man to operate the heating system and make a complete survey of the system at least once a month.

DISTRIBUTE EXTRA MATERIAL

WASHINGTON—Col. Charles R. Baxter, Ordnance Department, has been appointed chief of the new materials redistribution branch of the War Production Board. The new branch will take over the functions and personnel of the inventory requisiting branch, which has been responsible since last December for the movement to war industries of idle excess stocks of strategic materials. Colonel Baxter, who has 30 years of service in the Army, was recalled to active duty in the Ordnance Department in January.

11. Make every effort to obtain the cooperation of everyone in the building to save fuel by keeping windows and doors closed and by reporting overheating.
12. Control the temperature of hot water delivered to factory processes and washrooms at the minimum permissible.

Advisory Consultants for SWPC Appointed by Holland

WASHINGTON—A Board of Consultants, who will serve in an advisory capacity to the Smaller War Plants Division and to the Smaller War Plants Corp., has been named by Lou E. Holland, chairman of the board of the corporation. They include George Trundle, Trundle Engineering Co.; William B. Stout, Stout Engineering Laboratories; Stanley A. Carlson, Howe Machinery Co.; W. B. Connell, West Side Machine Works; and Ivan L. Johnson, Pacific Steel Casting Co.

In the selection of this group of advisors Mr. Holland points out that he has endeavored to combine high engineering talent and practical experience with the problems of small business.

Chart Shows Production Lost Due to Absenteeism

BOSTON—With the manpower shortage in some plants as critical as the shortage of vital materials, absenteeism in war plants is rapidly becoming a major management problem and a growing threat to the success of the national war production program.

The American Screw Co. found that on an average day almost ten percent of the workers were absent. Most of the absences were found to be due to no more serious cause than the worker's desire for a vacation.

In an effort to check the growing absenteeism, a chart was devised which showed the average amount of screws produced by each employee each day, the total number of employees absent for the day, the total amount of production lost for the day due to absence, and the number of workers absent from the department in which the chart is posted.

This chart, posted in each department, proved to the workers in actual figures, day by day, how vital production can be affected by a single day's absence of one employee.

The effect was immediate. The first week the plan was adopted the number of workers absent dropped steadily down to less than one-half the previous week. Four departments during that week reported no men out.

Each chart, printed in red, white and blue, is mounted on heavy paste board and is so designed that it can be conveniently hung in a prominent place. There are three slots into which the number of employees absent, the estimated loss of production for the day, and the number of workers absent from that particular department, can be inserted each day.

Inventors Council Kept Busy

WASHINGTON—A recent meeting of the National Inventors Council marked the completion of two years' work by the fourteen-man body created in 1940 to aid the Army and Navy by evaluating all suggestions of an inventive nature coming from the public. At the meeting the 100,000th suggestion was considered, but what it is has not been disclosed. Nor has the council revealed, because of military secrecy, the exact number of devices which it has passed along to the Army and Navy.

In connection with the meeting the council inspected a display of several inventions, among which an amphibious armored tank, a static equipoise for stabilizing motion of moving craft, a machine gun with non-recoil features, and a rapid fire cannon.

More Women for War Jobs

WASHINGTON—According to instructions to War Department employing and training officers, as far as practicable, women will be employed in preference to men of war service age or capabilities. Qualified men who are ineligible for military service will not be limited by this policy. Already, about 300,000 women are employed in War Department activities, working in arsenals and depots. Since June 1, 1942, the employment of skilled women workers in War Department activities has risen from three to ten percent. Almost 35 percent of the unskilled workers are women.

CORRECTION

NEW YORK—The report stating that the drawing press built by the Weber Showcase and Fixture Co. for the production of cowl ventilators (AM—Vol. 86, page 916j) is the largest ever built was in error. A number of drawing presses with larger capacity have been built.

G.M. SPEEDS AHEAD

NEW YORK — Employment by General Motors in the United States has reached approximately 313,000 during the week ended Sept. 13 as compared with 291,808 in June, 1941, the highest previous record. About 12 percent of the hourly rated workers are women. Employment is continuing to increase at a rate of about 4,000 a week. Employees worked an average of 46 hr. per week during the week ended Sept. 13, compared with 38.8 hr. during the corresponding week last year. Deliveries of war materials from General Motors plants in the United States and Canada increased 31 percent in August over those in July. The total for 1942 to date is $990,998,529.

CANADA BUILDS 200 WARSHIPS

OTTAWA—The value of orders placed under Canada's shipbuilding program has increased by more than fifty percent during the past year and now exceeds $757 million. Since the beginning of the war, Canada has launched more than 200 combat ships, including corvettes, minesweepers, patrol boats, base ships and other vessels. Approximately 1,000 smaller craft have been launched and 1,500 more are under construction. The program is being carried out in 21 major shipyards and 58 smaller boatyards located on the east and west coasts, the St. Lawrence, and the Great Lakes.

Army Speeds Plant Safety By Nation-Wide Program

WASHINGTON — An expansion of safety measures in Army installations and plants which are producing war materials has been ordered by Lieut. Gen. Somervell, head of the Services of Supply, War Department. Supervision of the accident prevention program has been assigned to Maj. Gen. A. W. Gullion, the Provost Marshal General, whose office is already responsible for plant protection and internal security.

In this drive for accident prevention the Services of Supply will cooperate with state and private organizations as well as federal agencies engaged in safety work. This division will promote an educational program to reduce to a minimum accidents resulting from ignorance or negligence on the part of manag-ment and employees.

The commanding generals of the Army's nine Service Commands (formerly Corps Areas) have been made responsible for operation of the program at plants, facilities and installations located within their territory.

In order to utilize all resources in combating accidents and to unify the efforts of government agencies, labor and industry, an advisory safety committee of the Services of Supply, composed of outstanding leaders in the field of accident prevention, will be established to determine policy and assist on procedure. To enlist the cooperation of local safety leaders in the program it is planned that similar advisory committees will be formed in Service Commands. Thus it is expected that nation-wide safety policies and a uniform system of inspection will be established to discover, eliminate or control hazards that cause loss of life and accidents among the millions of men and women engaged in turning out weapons and equipment.

Washington Appointments

WPB, Miscellaneous:

Charles E. Wilson, vice chairman, WPB; William M. Jeffers, rubber administrator; Hiland G. Batcheller, head, Iron and Steel Branch; Lou E. Holland, head, Smaller War Plants Division.

WPB, Field Offices:

J. J. Burnett, chief, Field Contact Branch, Bureau of Priorities; John F. McKernan, deputy director, Production Service Region II.

WPB, Industry Advisory Committees:

Presiding Officers: J. J. Donovan, Heavy Truck and Bus Parts Subcommittee, Driving Parts Subcommittee and the Engine Parts Subcommittee of Automotive Replacement Parts; R. J. Lund, Diamond; F. B. Millham, Refrigeration Wrought Copper Solder Type Fittings.

Office of Price Administration:

H. Seymour Pringle, head, Agricultural and Industrial Machinery Section, Standards Div.; Theodore M. Miller, acting head, Rubber and Rubber Products Section, Standards Div.; Edward T. Solomon, chairman, Industry Advisory Committee for Price Schedule No. 4, Iron & Steel Scrap.

War Manpower Commission:

William L. Batt, Channing R. Dooley, management representatives on Federal Committee on Apprenticeship will advise Federal Security Agency and WMC on apprentice training; James Bond, director, Region X; Joseph A. Smith, director, Region I; Mrs. Anna M. Rosenberg, director, Region II.

Office of Defense Transportation:

Charles T. O'Donnell, manager, Joint information Office, Cincinnati.

BUSINESS ITEMS

American Engineering Co., Philadelphia, Pa., has announced completion of a standardization program of sixteen sizes of their Hele-Shaw fluid power pumps. Standardization affects pumps in both the low pressure and high pressure ranges. Aside from the general improvement in deliveries and increase in pump production, standardization of Hele-Shaw pumps and controls will enable users to simplify their layouts and speed up production and servicing of Hele-Shaw fluid power operated equipment.

To meet increased war-time demands, the Ready-Power Co., Detroit, Mich., has erected ten temporary wooden buildings with a total of approximately 44,000 sq.ft. of floor space. Two storage buildings and an office building complete the plant layout.

The newly formed Rudel Machinery Co., 100 East 42 St., New York, has taken over many of the machine tool lines formerly handled by Henry Prentiss & Co. until the time of the latter's withdrawal from business on May 31. The manufacturers now being represented in northern New Jersey, eastern New York and Connecticut by the Rudel concern are: Acme Machine Tool Co., Avey Drilling Machine Co., Cincinnati Bickford Machine Tool Co., The Dennison Mfg. Co., Gould & Eberhardt, Racine Tool & Machine Co., The Stearns Rogers Co., and V & O Press Company.

A plant has been opened in Los Angeles by the Lee Welding Rod Mfg. Co., for the manufacture of electric welding rods of the structural or mild type. The company is headed by Lee Bergstrom, as president, formerly vice-president of the Bergstrom Steel Co. Arthur G. Brown, formerly manager of the Columbia Steel Company, west coast subsidiary of the United States Steel Corp., is associated with Bergstrom in the new company.

An addition to the plant of Osborn Mfg. Co., Cleveland, is announced by the company. The addition consists of a one-story building formerly occupied by the Lake Erie Lumber and Supply Co. The structure is being remodeled and equipped with an overhead conveyor as storage space.

NAMES in the NEWS

James S. Hagan of La Grange, Ill., has been appointed manager of the Northwestern District of the Westinghouse Electric and Manufacturing Co.'s district manufacturing and repair department, with headquarters at Chicago. He succeeds R. E. Powers, now serving as Pacific Coast District manager of the department.

Bradford C. Colcord, formerly general superintendent of the U. S. Steel Corporation's National works at McKeesport, Pa., has been promoted to assistant vice-president in charge of

Workers' Tours — Believing men work better if they know what they're producing, Wright Aeronautical Corp. conducts plant tours, shows them the finished product. The "Cyclone Room", above, combines the features of a movie theatre, science museum, library and space where employees may examine finished engine

operations, with headquarters at the general offices in Pittsburgh. Ralph M. Overton, formerly assistant general superintendent, has been advanced to general superintendent of the National works. O. P. Adams, formerly superintendent of maintenance, has been promoted to assistant general superintendent.

Ransom Soper is now handling the Brooklyn and Long Island territory for the Wilson Brown Co. He was formerly with Henry Prentiss for a number of years. E. N. Moor will handle the company's Connecticut territory. He was for the past several years with Jones & Lamson Machine Co., and at one time in charge of their London office. Mr. Moor has been in the machine tool business for twenty-five years or more.

R. R. Higgins, formerly secretary and treasurer of the Standard Tool Co., has been elected president of that company. E. E. Wegman has been elected secretary and J. W. Bremer, treasurer. W. P. Ross, who is at present the sales manager, will be elected vice-president at the next stockholders' meeting. Each of these officers has been connected with the company for thirty years. H. C. McKean has resigned as general manager, and will retire due to ill health.

D. J. McCarthy has been appointed manager of the newly-formed sub-contract division of the Casco Products Corp., Bridgeport, Conn. Mr. McCarthy has been secretary and sales manager of the company's automotive division for the last eight years and has been associated with the automotive industry for 27 years in manufacturing, sales and service capacities.

A. G. York has been appointed vice-president in charge of sales for the Watson-Stillman Co. He was formerly assistant to the president and managing director of the forged steel fittings division of the company. He now fills the vacancy created by the resignation of J. C. Grindley, due to ill health.

W. G. McFadden has been appointed acting manager of the Chicago office of the Allegheny Ludlum Steel Corp. He replaces P. E. Floyd, now serving with the government.

Irwin A. Marshall has been appointed to the contract engineering staff of Foote Bros. Gear and Machine Corp., to represent the company in the Cleveland and Northern Ohio territory.

Robert P. Freehafer has been advanced to purchasing agent of the Carpenter Steel Co. He was formerly assistant purchasing agent of that company.

OBITUARIES

Otto Mueller, managing director of the Pressed Steel Co., Oxford, England, died recently in a nursing home there, following a long illness. He was fifty-five years old. Mr. Mueller was formerly associated with the Edward G. Budd Mfg. Co. in Philadelphia and Detroit, and was sent to England by that company in 1926 to manage the Pressed Steel Co. He joined the Budd organization in 1925 as manager of the Detroit division. His last visit to the United States was in 1932.

Arthur Ulrich, 83, secretary of Colt's Patent Firearms Mfg. Co., Hartford, Conn., for 40 years, died recently. Mr. Ulrich had been employed by Colt's for 56 years and was an expert on firearm mechanism.

Charles S. Lindsay, president of the Heppenstall Co., Bridgeport, Conn., died recently.

Gustav Harcke, an employee of Air Reduction since 1916, died recently. He was active for many years lecturing and conducting demonstrations throughout the country. In recent years he devoted his services to building up the engineering and data files of Airco's general library.

MEETINGS

American Gear Manufacturers Association. Semi-annual meeting. Skytop Lodge, Skytop, Pa. Oct. 15-17.

American Society of Mechanical Engineers. Fall meeting. Sagamore Hotel, Rochester, N. Y. Oct. 12-14.

American Society of Tool Engineers. Semi-annual meeting. Kimball Hotel, Springfield, Mass. Oct. 16-17.

American Welding Society. Annual meeting. Hotel Cleveland, Cleveland, Ohio. Oct. 12-16.

Associated Machine Tool Dealers of America. Fall meeting. Hotel Pennsylvania, New York, N. Y. Oct. 7.

Industrial Hygiene Foundation. Annual meeting. Mellon Institute, Pittsburgh, Pa. Nov. 10-11.

National Electrical Manufacturers Association. Annual meeting. Waldorf-Astoria Hotel, New York, N. Y. Oct. 26-30.

National Exposition of Power and Mechanical Engineering. Madison Square Garden. Nov. 30-Dec. 4.

National Founders Association. Annual meeting. Waldorf-Astoria Hotel, New York, N. Y. Nov. 18-19.

National Metal Congress and Exposition. War Production Edition. Cleveland Public Auditorium. Oct. 12-16.

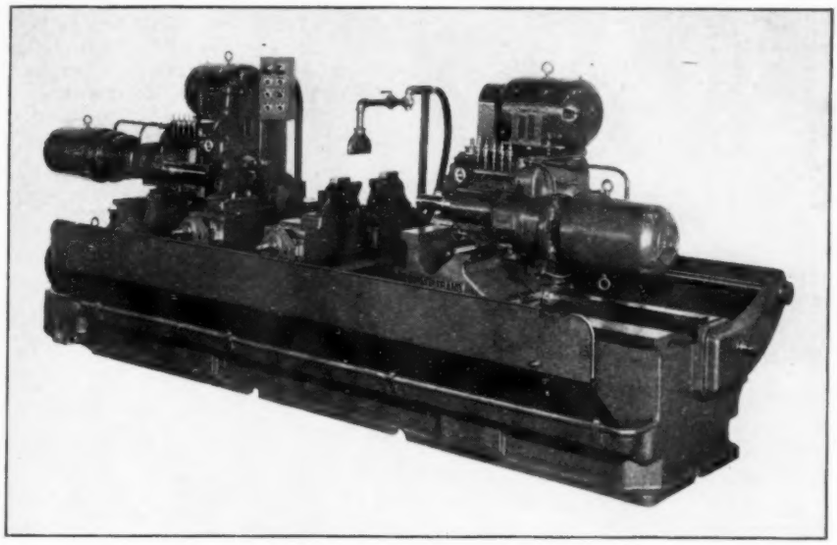
National Safety Council. Annual meeting. Chicago, Ill. Oct. 5-9.

Society of Automotive Engineers. National Aircraft and Production meeting and Aircraft Engineering Display. Biltmore Hotel, Los Angeles, Calif. Oct. 1-3.

Wire Association. Annual meeting. Hotel Carter, Cleveland, Ohio. Oct. 19-23.

SHOP EQUIPMENT NEWS

Sundstrand Double-End Milling, Centering Machine Performs Work on Both Ends of Shaft in One Set-Up



A double-end milling and centering machine suitable for milling to length and centering, in one handling, both ends of shafts 1⅛ to 6 in. diameter by 14 to 72 in. long. has been introduced by Sundstrand Machine Tool Co., Rockford, Ill. Two sub-bases are mounted crosswise to the bed ways that have ways on which cross feeding heads are attached. The left hand sub-base is fixed but the right hand base is adjustable for handling various lengths of stock. Two screw operated self-centering vises for holding the work are mounted to the bed ways between the two heads. These vises are also adjustable for handling various lengths of stock. The drive to the heads is by means of a main drive shaft which is driven by a fluid motor. Each milling head carries a cam-operated automatic centering spindle.

A shaft is loaded into the work holding vises in one cycle of operation. To mill both ends of the part to length the operator presses the cycle control button which starts the cross feed of the heads towards the front of the machine. At the completion of the cross feed for milling, the heads return toward the rear of the machine until the centering spindles are in correct position and then stop. The centering spindles automatically travel longitudinally in a cycle of rapid approach, feed, return and stop. Since the cycle is completely automatic, the operator is available to run several machines.

A feature of the machine is the use of Sundstrand hydraulic equipment including a tank unit, fluid motor and valves to provide the automatic cycle for feeding the heads. Electrically operated vises can also be provided to further simplify loading and unloading of the work. A machine of similar type can be provided for handling shafts 1 to 4 in. diameter by 8 to 48 in. long.

Blount Wet Tool Grinder Has Table Adjustable in Three Planes

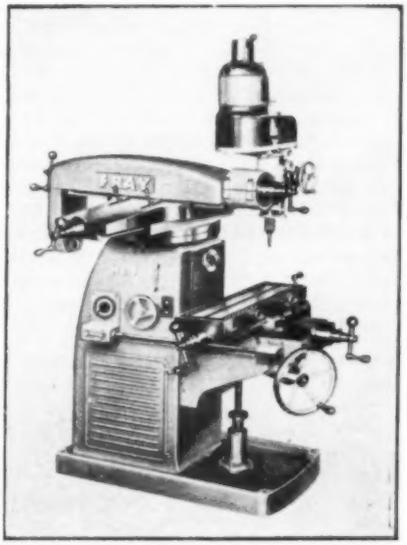
An adjustable table is included in the Model F.T.C. special wet tool grinder produced by the J. G. Blount Company,

Everett, Mass. This grinder is intended for tungsten carbide tools. The table is adjustable in all three planes. The table top is of hardened and ground steel. Milled guides are provided parallel to the face of the wheel in which the protractor guide slides. The table is supported by a heavy bronze elevated screw with hand wheel. The table may be raised or lowered approximately 2 in. from center of wheel. Angular adjustment up to 35 deg. may be obtained in all planes. Adjustment of two angles is obtained in the table while the third angle with respect to the face of the wheel is obtained with the sliding protractor guide.

The method of grinding is free-hand. The tool is held against the protractor guide and thus directed at the proper angle against the wheel.

Fray Produces Milling Machine Suited to All-Angle Operation

A No. 9 horizontal and vertical milling machine which will handle practically any operation, at any angle or compound angle has been announced by



Fray Machine Tool Co., Glendale, Calif. The turret head is reversed for horizontal milling and the vertical attachment is swung back out of the way. Milling, drilling or boring operations can be performed at any angle, crosswise by operating the ram in its saddle, or longitudinally by traversing the ram on the turret slide. A wide range of operations is provided when these two movements are used in conjunction with the head. The ram has a

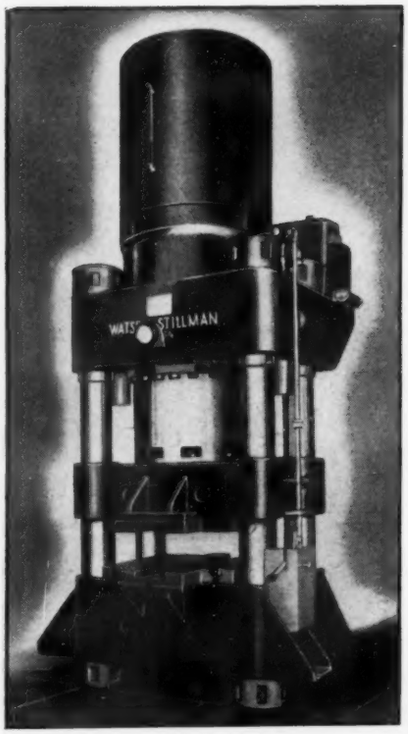
cross travel of 10 in. and a longitudinal travel of 18 in.

The No. 9 machine is usually furnished with Fray Type E head, and the motor may be swung completely around the housing and locked at any point. An instant change from micrometer wheel feed to hand lever feed can be made. The spindle travel is 4 in. Cross travel of the table is 9 in., with longitudinal travel of 20 in. and vertical travel of 16 in. The working surface is 9½×36 in. The motor for the vertical head is 1 hp., and for the horizontal spindle is 3 hp.

Watson-Stillman Forming Press Has Automatic or Hand Control

A 1300 ton forming press arranged for single cycle automatic operation or manual control has been announced by the Watson-Stillman Co., Roselle, N. J. This unit is entirely self-contained, including the 50 hp. motor and radial piston pump which delivers 45 gal. per min. The single lever latch control is operated by a pressure cylinder.

The press is a vertical 4-column type, and has a ram of 35 in. dia. which exerts a pressure of 2,750 lb. per sq. in. with a 22 in. stroke. The opening is 37 in., with a clear platen area of 48×42 in. It has a pressing speed of 10.5 in. per min., and advance and return speeds are 650 in. per min.



The machine occupies a floor space of 8×6 ft. and has an overall height of 19 ft.

Delta Toolmaker Grinder Utilizes Two-Piece Adapter

The Delta Manufacturing Co., Milwaukee, Wis., has introduced the Toolmaker surface grinder which is portable and includes several outstanding features. A unique wheel-mounting arrangement utilizes a two-piece adapter. The advantage of this is that once a wheel has been trued up it can be removed and replaced with the adapter and without any further dressing.

An extra long spindle with widely spaced bearings at either end that provide permanent true alignment has been incorporated. The forward bearing runs in a continuous bath of oil while the rear bearing is completely sealed and requires no lubrication.

The table has long ways on which it rides solidly. Gibs are provided so that all play caused by wear can be eliminated. A micrometer collar with wide graduations on the traverse adjustment permits accurate settings. T-slots are provided in the table for clamping fixtures or magnetic chuck in place.

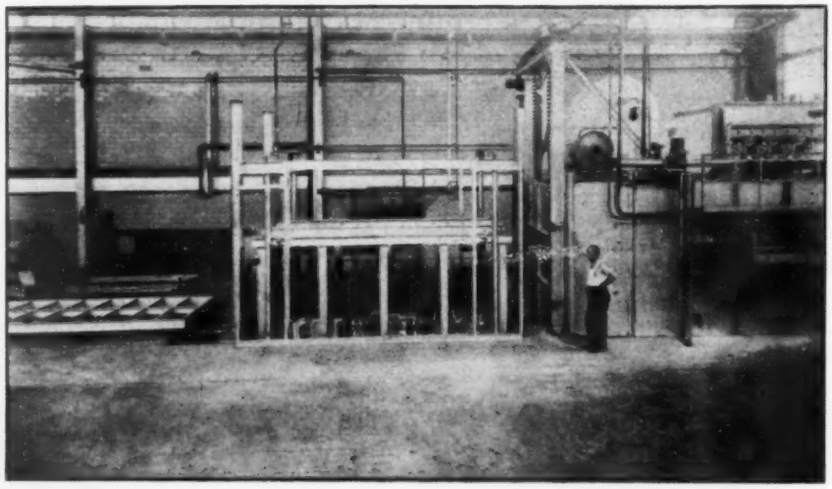
A specially designed column is made of one-piece construction. A steel gib guides the bracket yoke so that it is always in perfect alignment. The column, together with the bracket, may be rotated 360 deg.

The maximum length that can be ground is 13½ in. and maximum width that can be ground is 6 in. The table surface is 5¾×13 in.

Despatch Heat-Treating Furnace Will Quench Castings Rapidly

A heat-treating furnace which handles all types of aluminum or magnesium alloys has been built by Despatch Oven Co., Minneapolis, Minn. It is capable of quenching 8,000 lb. of castings in 25 sec. it is claimed. The furnace is of the radiant tube convection type with an indirect gas heater. The heat flow from side ducts is vertical and horizontal and passes outward through recirculating ducts. Work chamber uniformity is ± 5 F., with automatic temperature control. The alloy steel fan handles 20,000 cu. ft. per min.

A series of rollers are mounted in the loading section, on the top and in the interior of the elevator quench cage and on the bottom of the furnace work chamber. These rollers form a level roadway from the loading section to the furnace whether the quench cage is up or down. In operation a processed load is withdrawn by air winch from the furnace onto the elevator cage, then dropped quickly into the quench bath. The raw load is then pulled directly into the furnace, passing over the quench bath on the rollers.



Rouse Hand Bench Miller Suitable for Small Parts

An inexpensive, light, high speed, ball bearing, motor driven hand miller has been introduced by H. B. Rouse & Co., 2214 N. Wayne Ave., Chicago, Ill. This

Precious minutes saved!

Unit saving and production increase of dogs for armored doors are multiplied by this battery of Monarch lathes.

Taking advantage of the versatility of Monarch lathes, this producer of dogs for armored doors and hatches on conning towers has reduced machining time to less than one-half the former schedule.

About half the previous time was devoted to facing and counterboring—now accomplished more than twice as fast on a Monarch lathe. Facing the dogging surface absorbed the other half of the finishing time—now done on a Monarch with an interrupted cut in 60% of the previous time. Thus Monarch does both jobs in less time than previously was required for either one.

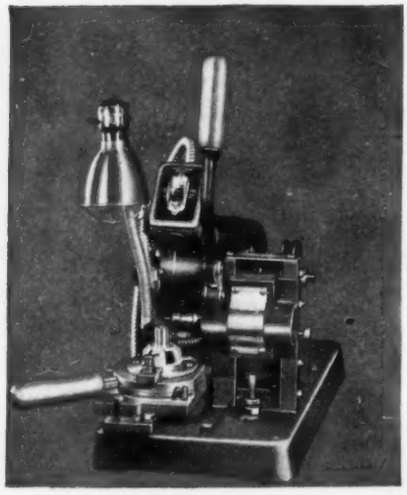
A double advantage is thus gained. More pieces produced per hour, and machine tools released for other work.

Today, when every production minute saved is precious, and when every machine tool is so urgently needed, this example will help other plants produce faster for fighters.

THE MONARCH MACHINE TOOL COMPANY • • • SIDNEY • OHIO

MONARCH LATHES

COVER THE TURNING FIELD



is a bench machine which is suitable for handling light cuts in aluminum, brass and similar materials on small parts for electric motors, airplanes and the like.

High production may be attained by use of special fixtures developed for each particular piece. The spindle is adaptable so that either small end mills or small circular milling cutters can be used on this machine.

Fleetweld Coated Electrode Provides Maximum Welding Speed

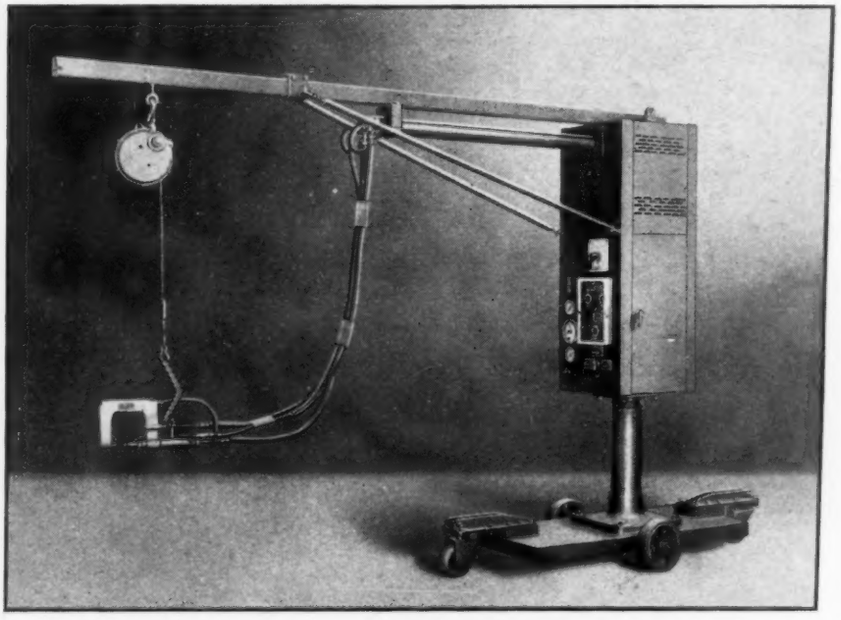
Designed especially for use with the "Fleet-Fillet" technique of arc welding the Lincoln Electric Co., Cleveland, Ohio, has announced a new electrode known as Fleetweld 11. It is a shielded arc type and heavily coated to exclude oxides and nitrides from the weld. The electrode is fast flowing and gives deep penetration of metal into the joint. It is held at an angle of 45 to 60 deg. with the horizontal plate, and 90 deg. with the electrode path along the joint. The arc produced is so short that the electrode coating practically touches the metal. Fleetweld 11 is made in 18-in. lengths and two diameters, 3/16 and ¼ in., packed in 50 lb. cans.

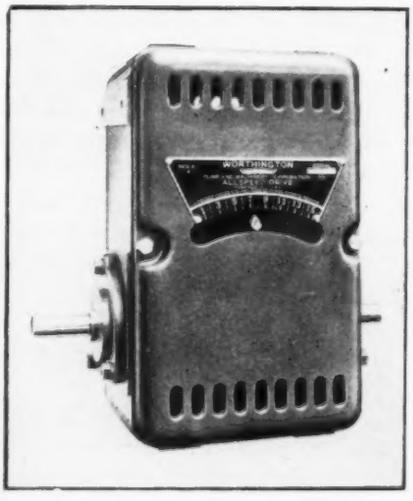
Sciaky Builds Radial-Type Gun Spot Welder In Both Stationary and Buggy-Mounted Units

A radial type gun spot welder in both stationary and buggy-mounted styles is offered by Sciaky Bros., 4915 W. 67 St., Chicago, Ill. A special welding timer which has been included in this machine operates on single phase a.c., 220 or 440 volts. A hydro-pneumatic booster supplies hydraulic pressure which can feed a gun capable of supplying a maximum electrode pressure of 1,800 lb. with 90 lb. per sq.in. of air supply.

Secondary cables are thin, flexible and short. The reduction in the usual size is made possible because of the use of fixed, heavy copper bars in the length of the secondary circuit.

This welder is suited to welding corrosion-resisting, pickled, zinc-coated steels and Monel metal in thicknesses of from 0.016 in. plus 0.016 in. up to 0.064 in. plus 0.064 in. Two unequal thicknesses can also be welded up to a total welded thickness of 0.500 in. provided one of the two thicknesses does not exceed 0.040 in.



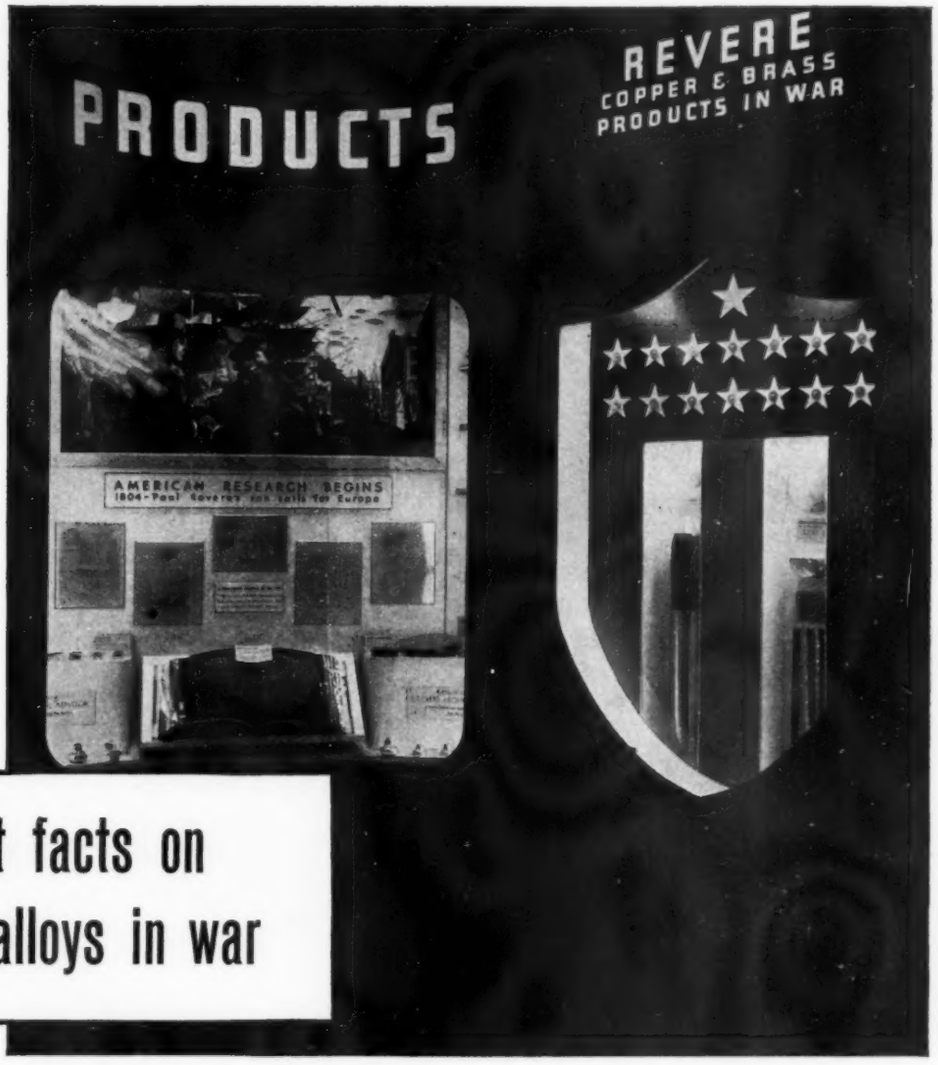


Worthington Allspeed Drive Will Operate In Any Plane

Worthington Pump and Machinery Corp., Harrison, N. J., has developed a variable speed multiple V-belt drive called the Allspeed Drive. It is designed for operation in any plane, and can be directly coupled to any standard motor and the output shaft can be run at motor speed. The horsepower range of this Model A unit is from 1/3 to ¾ hp. A feature of the drive is its positive belt-tensioning device which automatically compensates for increased arc of belt contact resulting from the changing from low to high speeds. No springs are required in this device and the drive does not need dismanteling to change belts. Although originally intended for application to machine tools, the Allspeed Drive has been used satisfactorily on several other types of equipment.

Linley Miller and Jig Borer Now Built With Three T-Slots

Several improvements have been made in the high speed vertical milling machine and jig borer produced by Linley Brothers Co., Bridgeport, Conn. The table size has been increased to 7×17½ in. and has three T-slots instead of one. The longitudinal travel is 10 in. and the cross travel 6 in. The hand wheel is on the left and the maximum distance from the table top



Get the latest facts on copper-base alloys in war

From October 12th to 16th, the National Exposition of the American Society for Metals in Cleveland will spread before production executives and technical men the complete story of metals in war.

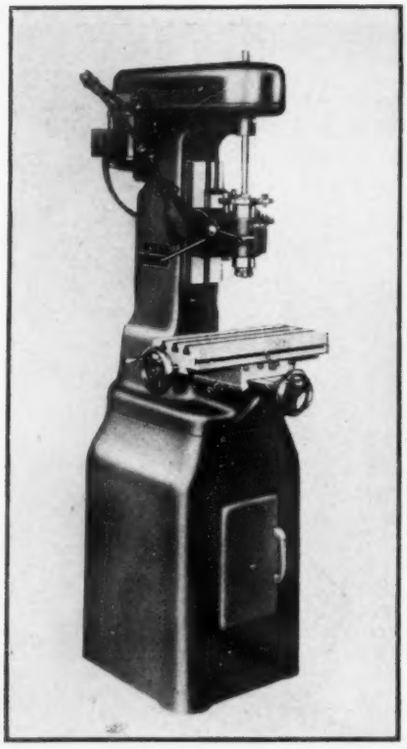
New developments, concrete examples of improved and new products, technical information, ways of beating schedules, use and availability of products, substitute materials, conversion to war production —all of these will be presented in the way that can help you most.

The Revere exhibit covers the field of copper and copper-base alloys. It is manned with technical and production men, who are able to give you the kind of information you can put to immediate use.

If you are unable to come to Cleveland, remember that the Revere Technical Advisory staff is always available to place such information before you, to answer difficult questions, and to work out practical solutions to your copper and copper-alloy problems.

VISIT THE REVERE EXHIBIT BOOTH NO. B-306

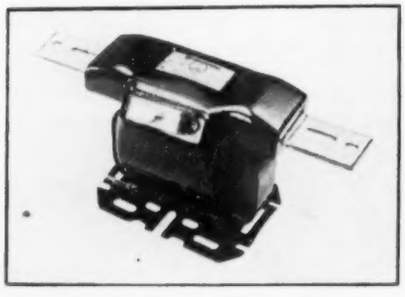
REVERE COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
Executive Offices: 230 Park Avenue, New York
Sales Offices and Distributors in Most of America's Major Cities



to the spindle nose has been increased to 11½ in. The shorter column ways at the lower end permit more clearance for the work on the table. The horsepower required is ½, and the machine occupies a floor space of 18½ in. wide by 20 in. deep.

Westinghouse Transformer Holds Temperature Constant

For accurate metering and relaying applications a line of Type CT standardized indoor current transformers has been announced by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. They are designed for full current continuous operation without



exceeding 55 C. temperature rise. These transformers are mechanically interchangeable with similar equipment of other manufacturers made to meet the same specifications.

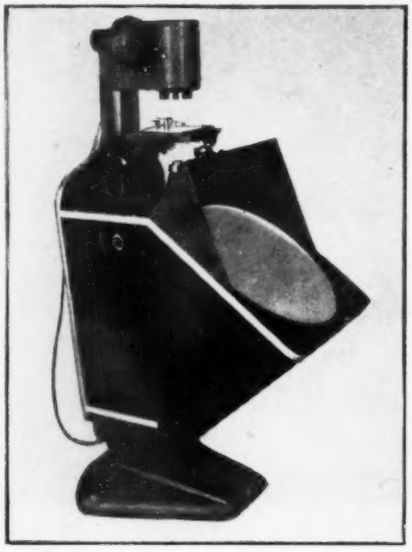
The primary and secondary coils are entirely separate and the construction and method of assembly give maximum mechanical and electrical strength. The transformers range from 5,000 to 15,000 volts at 25-60 cycle, with primary rating of 5 to 800 amp.

Portman Optical Comparator Built With Large Image Screen

Announcement of a Model P220 optical comparator with a 20-in. screen has been made by the Portman Machine Tool Co., 19 Beechwood Ave., Mount Vernon, N. Y. This large diameter image screen allows projection of an unusually large area.

This comparator is equipped with dial indicators for taking continuous readings, with a coordinate type stage, surface illuminators for projecting the surface characteristics of a part, and a blower system which is attached to the light-source assembly inclosing the condenser lens unit. The light beam filters through a colored heat-absorbing glass unit within the condenser lens, providing a soft light over the entire screen.

The equipment can be furnished with

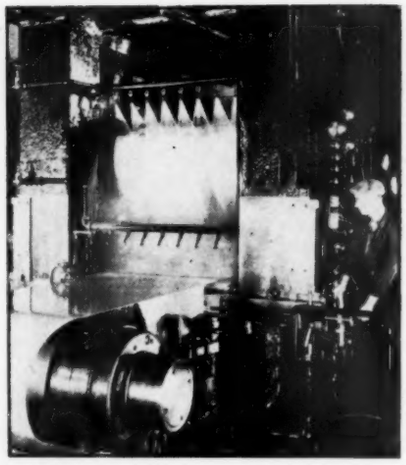


lens units of 10×, 20×, 30×, 31¼×, 45×, 50×, 60×, 62½×, 80× and 100× magnifications. The light source operates on 110 to 120 volts, either a.c. or d.c. current. The comparator measures 58 in. high, 26 in. wide and 36 in. deep, and weighs about 400 lb.

Chain Belt Rex Spray Nozzle Gives Flat, Uniform Spray

A non-clogging flat spray nozzle giving uniform distribution of water has been introduced by the Chain Belt Co., Milwaukee, Wis. The Rex spray nozzle requires no adjustments to its operation and no assembly of parts is required. It is suitable for washing, cleaning, cooling and descaling and has a spray strong enough to remove dust, grit and dirt from irregular surfaces, also efficient enough to cool an object evenly and quickly. The tapered inlet and round orifice will pass foreign material of approximately the size of the orifice.

The Rex nozzle is provided in three sizes, the large with 9/16 in. standard



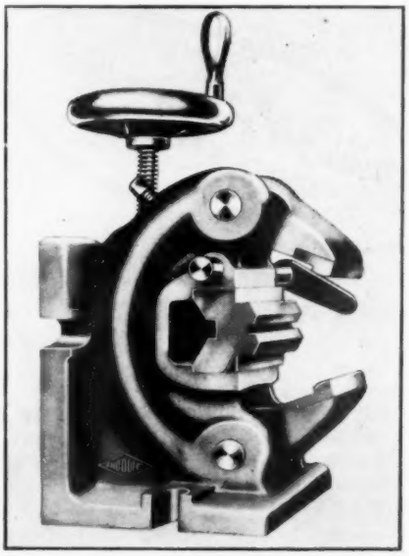
throat opening, 1 in. pipe thread; the medium with 11/32 in. opening, ¾ in. pipe thread; and the small size with ⅛ in. opening, ⅜ in. pipe thread.

Producto Self-Center Shaft Vise Mounts Vertical or Horizontal

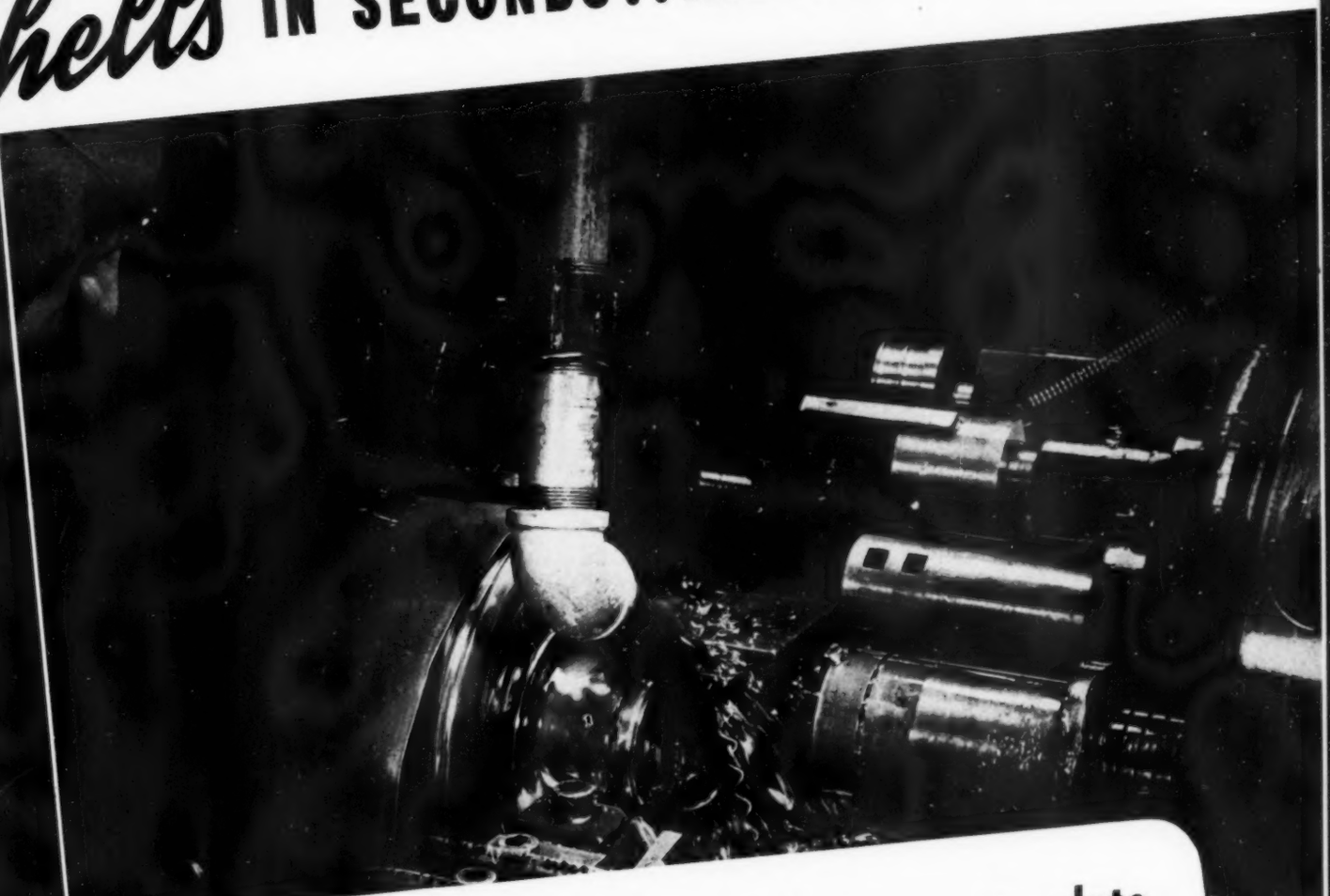
For holding spindles or shafts in performing such operations as keywaying, slotting or splining the Producto Machine Co., Bridgeport, Conn., has brought out a self-centering shaft vise. This tool can be mounted vertically or horizontally on the machine table. The work is held against a hardened V block by equal movement of two jaws controlled from an operating screw, thus centering the work for all sizes within the capacity of the vise.

Shafts or spindles ⅜ in. to 3⅛ in. diameter and any necessary length can be handled on the vise. An adjustable stop for locating work lengthwise is fitted to the vise. The V block is reversible for small and large work.

The size of the base is 8×7¼ in. and 8×5½ in., the V block is 4½ in. wide, the center height is vertical 5 in., horizontal 4⅜ in. The base is fitted with keys for locating on the machine table.



Shells IN SECONDS..INSTEAD OF MINUTES



SUNICUT helps shell plant run complete 8-hour shifts without tool change or regrind

Shells that a short time ago required minutes to machine now are produced in seconds.

At one of America's great armament plants, batteries of automatics are turning out shells on a 'round-the-clock schedule, running complete 8-hour shifts without a tool change or regrind, and Sunicut, the transparent, sulphurized cutting oil, is a vital contributing factor.

Sunicut was adopted at the recommendation of Sun Oil Engineers—those well-known Doctors of Industry. Its success has been phenomenal. Sunicut's exceptional heat-absorbing and metal-wetting qualities permitted the increased tool life, fine finish and "nth" degree accuracy that made this production possible.

Get more production per shift in your plant. A Sun Doctor of Industry is ready . . . willing . . . and able to help you. Call on him today. For other examples of how Sun Engineers and Sunicut are helping industry step up production for victory, write for free copy of "Helping Industry Help America."

SUN OIL COMPANY • Philadelphia

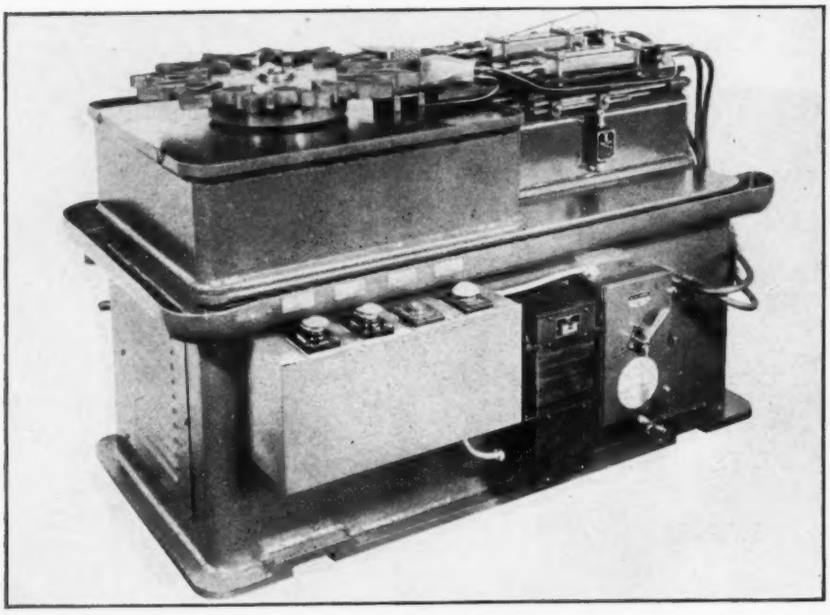
Sun Oil Company, Ltd., Toronto

BUY WAR BONDS AND STAMPS

SUNOCO

SUN PETROLEUM PRODUCTS HELPING INDUSTRY HELP AMERICA

Hydraulic Machinery Flame Hardening Machine Has the Working Parts Shielded From the Heat



Hydraulic Machinery, Inc., 10421 Grand River, Detroit, Mich., has introduced a flame hardening machine with the base and external housing structures of welded steel. Positive and flexible operation are provided by electrical control and hydraulic power. The parts which require adjustment and regular maintenance are located on the outside.

Completely adjustable pilot light, burners and water coolant are located on the rear slide together with proper shielding that directs the flame and water to the exact surface desired. The working parts in the machine are adequately shielded from the heat. The sprocket or part to be hardened is manually loaded onto the index table, pilot positioned with a locating pin and after pushing the start button the machine goes through its complete cycle and stops, then it is manually unloaded.

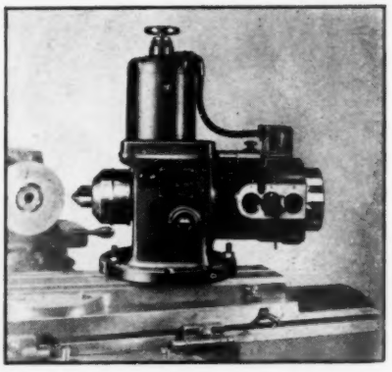
American Welders Optical Garment Will Prevent Hot-Spark Injuries

A wide assortment of welders' safety clothing to protect clothes and skin from hot sparks has been brought out by the American Optical Co., Southbridge, Mass. The clothing is made of the highest grade chrome-tanned cowhide and fire-resisting duck is used for backing. All seams are double cotton stitched and reinforced with metal stitching. The coat and cape sleeves have flat seams to prevent irritation. Reinforcing rivets are used in areas of extra tension to give added strength and longer garment life. The garment is equipped with large, durable snap fasteners.

Pratt & Whitney Attachment Made For Sharpening Single Lip Drills

Pratt & Whitney Div., Niles-Bement-Pond Co., West Hartford, Conn., has announced a deep hole drill sharpening attachment to sharpen single lip drills, with straight or helical chip grooves, within a diameter range of 5/8 to 2 in. Provision has also been made for sharpening V-shape drills or other cutting tools of similar shape.

The drill to be sharpened is located by keys in the spindle, which is hollow to accommodate drills of any length, with or without shanks. A cylindrical cam attached to the rear



of the spindle has three different cam grooves. Selection of the cam action is made by insertion of a removable cam roller into the desired groove. The spindle is driven by a 1/8-1/4 hp. two-speed motor, or it may be rotated manually depending upon the operation.

The sharpening attachment clamps on the standard table of a universal cutter grinder or grinders of similar design.

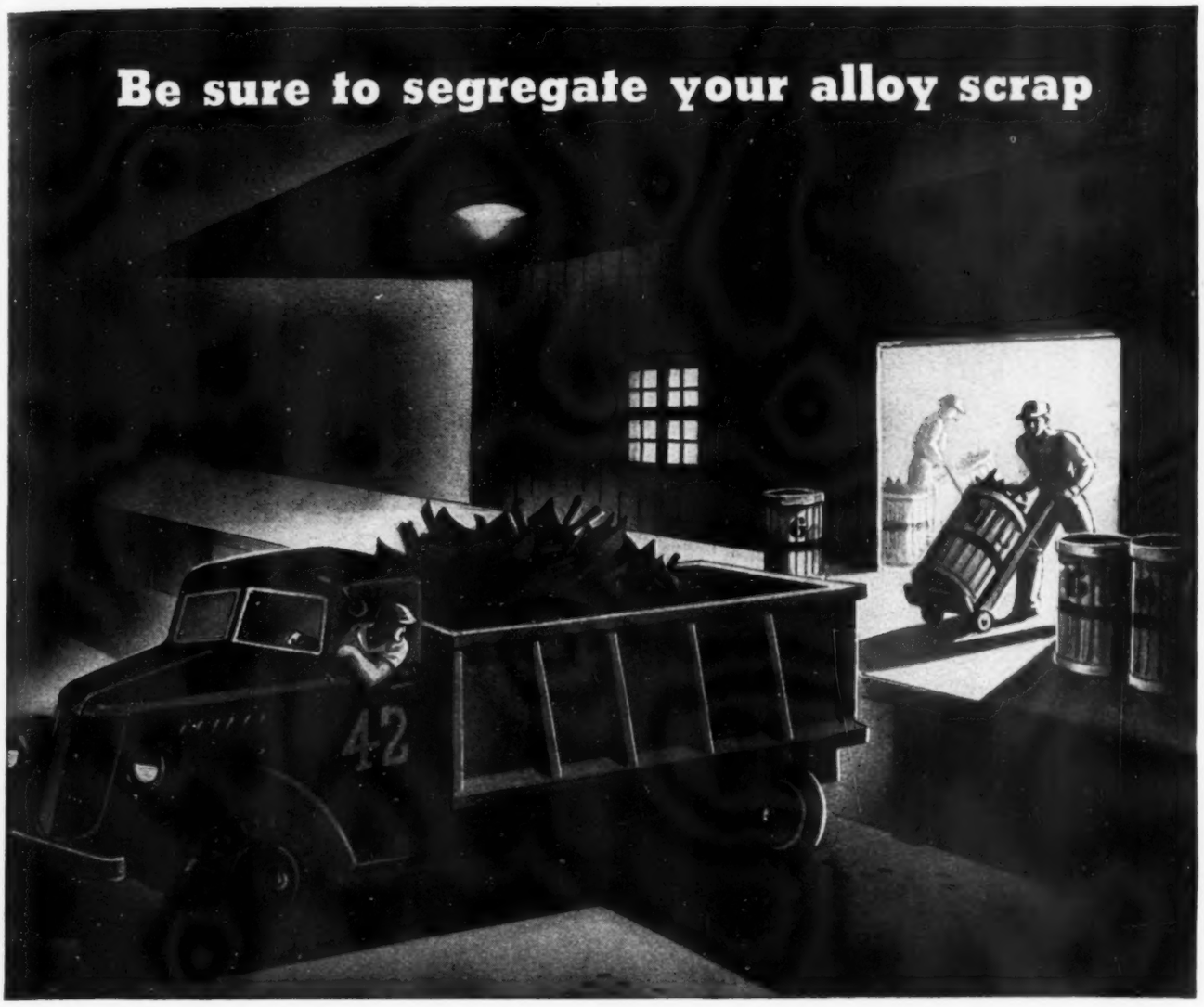
A.T.C. Vernier-Set Timers Include Design Improvements

Recent design improvements have increased performance characteristics on the Series 2800 Vernier-Set timers produced by the A. T. C. Co., Inc., 34 E. Logan St., Philadelphia, Pa. A leaf-spring contact for positive make-break

action is now provided. A one-piece molded-Bakelite terminal block accommodates all external wiring to clearly mark screw post terminals, as well as bridge positions. Timer and load circuits are now wired independently on all types. Foaminol and special flexible wiring are employed throughout the timer.

Standard units may operate from 110 or 220 volts, 25, 50 or 60 cycles. Load contacts are rated to carry 25 amp. at 110 volts, a.c. non-inductive, thus frequently eliminating use of intermediate contactors or relays.

Be sure to segregate your alloy scrap



Careful segregation and identification of alloy iron and steel scrap should be standard procedure in every plant collection program.

1. It helps conserve essential, scarce alloying elements.
2. It helps eliminate wasted time, material and effort in the steel mills.

Alloying elements such as cobalt, molybdenum, nickel and tungsten are readily recoverable from scrap. If their presence in a lot is known, the scrap can be used in making up a charge of alloy steel of the same or similar analysis. The amount of alloying elements that must be taken from stock is reduced.

But, if, through lack of segregation, alloy scrap gets into a charge where no alloys are wanted, such as a plain carbon steel, the alloying elements are utterly wasted. It is also possible that the heat itself will be lost because of failure to meet specifications.

The difficulties of scrap segregation increase with every handling. The source is the best point for segregation. Comparatively little time and trouble taken there will save a great deal of trouble and wasted time at the mill.

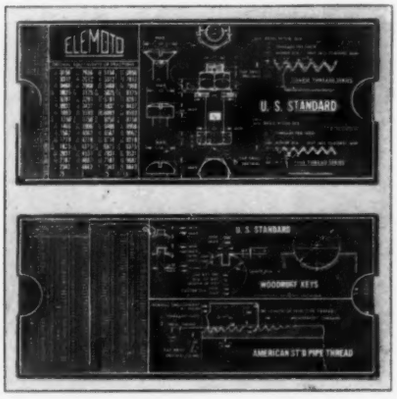
CLIMAX FURNISHES AUTHORITATIVE ENGINEERING DATA ON MOLYBDENUM APPLICATIONS.
MOLYBDIC OXIDE—BRIQUETTED OR CANNED • FERROMOLYBDENUM • "CALCIUM MOLYBDATE"

Climax Mo-lyb-den-um Company
500 Fifth Avenue • New York City

MOLY

Elemoto Slide Chart Provides Many Part Size Specifications

A convenient pocket size slide chart which gives American Standard dimensions and data for all sizes of elementary parts has been made available by Elemoto Sales Co., Teaneck, N. J. It is useful in determining sizes of parts such as nuts, bolts, plain or lock washers, pipe threads, Woodruff keys, and top drill sizes. The specifications are obtained with one movement of the slide which operates on a simple slide rule principle.

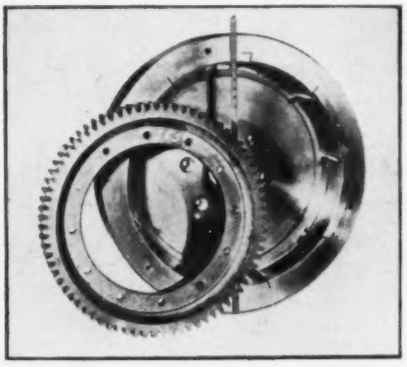


Dimensions of countersunk, fillister, round and hexagon heads are also given. The slide includes tabulations on decimal equivalents, twist drill and steel wire gages, sheet and plate gages, and conversion figures between millimeters and inches.

Charles Cotta Chuck for Gears Reduces Loading Time to Minimum

A Speed-Chuck for holding spur or helical gears for hub, hole or face grinding and similar operations has been developed by Charles Cotta, 1712 Harlem Ave., Rockford, Ill. It is claimed that loading and unloading time is reduced to a minimum because the gear is simply set into the chuck where a slight turn causes it to be gripped firmly by a set of hardened and ground pitch-line pins. These pins bear against a set of accurately ground eccentric cams placed to tighten against the normal direction of rotation. A slight turn of the gear in the opposite direction releases the chuck.

Alignment is automatically accurate with the Speed-Chuck because the pins are sized to bear at the pitch line and the cams are carefully ground to assure concentricity. Various types are available for single or cluster gears with size ranges from 3 to 36 in. diameter.

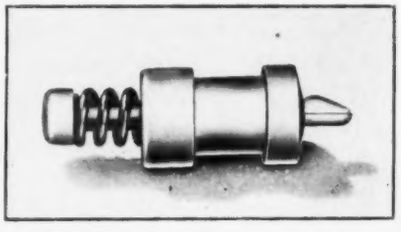


Lever-Seald Plug Valves Operate at 150 Lb. Pressure

A line of Lever-Seald plug valves for 150 lb. working pressure has been introduced by Homestead Valve Mfg. Co., Coraopolis, Pa. Since the face to face dimensions of these valves are the same as those of the corresponding size of wedge-gate valves, they are instantly interchangeable with them and do not require piping changes. A powerful leverage provides ease in opening or shut-off. Size ranges of the plug valve, in either steel or semi-steel, are from 1½ to 10 in.

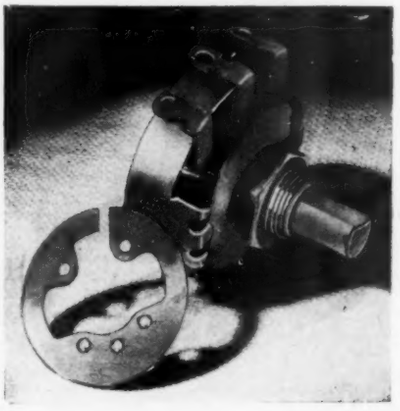
Prestite Aircraft Skin Holder Insures Permanent Gripping Action

For use in assembling aircraft skins with ease and safety the Prestite skin holder has been developed by Prestole Devices, Div. of Detroit Harvester Co., Toledo, Ohio. A solid integral head holds the pin safely in position and thus eliminates the danger of injury to the worker. The work is held in constant registration while extra spring tension holds the skins tighter during fabrication. A single straight thrust is all that is required for a permanent gripping action. Prestite fasteners are available in all popular and many special sizes.



Clarostat Series 37 Controls Feature New Coating Element

A new stabilized element which consists of a resistive coating on a Bakelite base, practically as smooth and hard as glass, has been incorporated in the Clarostat Series 37 controls made by Clarostat Mfg. Co., Inc., 285–7 N. 6th St., Brooklyn, N. Y. The element is chemically treated during processing to eliminate all further changes in its composition. It is heat-treated to stabilize its temperature and humidity characteristics.



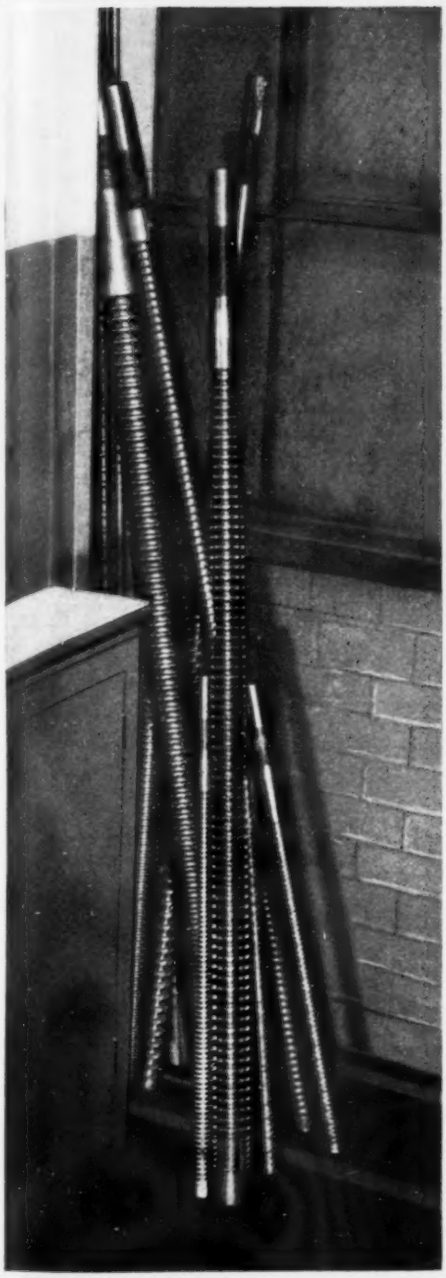
Steel-Grip Finger Guard Improved With Leather Back

Improvement in the Steel-Grip finger guard for certain types of punch press work, sanding, burring, grinding, buffing and so forth has been announced by Industrial Gloves Co., Danville, Ill. A leather section over the back of the finger at the tip end has been added, thus assuring protection on the back of the finger, or thumb, as well as the front. Special elastic webbing on the back provides adaptability for different sized fingers and for a close, cool fit.

Hobart Remote Control Unit Uses Lamp Cord Connection

For improving weld quality Hobart Brothers Co., Troy, Ohio, has introduced a remote control unit which is easily set up by the use of an ordinary lamp cord extension to connect it to

THE QUICKEST WAY TO SPOIL GOOD BROACHES . . .



. . . Lean them against each other in a corner

How to get more production with your Broaches------

1. BY PROPER HANDLING

IT TAKES time to recondition a damaged broach. Careless handling of your broaches may tie up production. Here are a few good rules to follow to protect these vital war tools:

(a) Always provide individual storage racks for broaches. These should either be of a material that will protect the teeth from damage or else should be lined with such material. If cutting edges of broaches are allowed to strike against each other they may be chipped or nicked.

(b) Never drop a broach on any hardened surface. Broaches are usually made of high speed steel and may even be tipped with tungsten carbide. You may chip, nick, or even break the teeth.

(c) When broaches are to be stored for any period of time they should be treated to protect them against corrosion.

(d) Equipment for moving broaches from one department to another should have separate compartments to prevent nicking of broach teeth.

COLONIAL broaches are designed to enable you to machine your parts more accurately, quicker, and at a lower tool cost per piece than with virtually any other method of stock removal. Give them a chance to do an all-out job for you. Handle them carefully.

colonial BROACH COMPANY

Broaching Machines — *Broaches-Broaching Equipment*

DETROIT . . . . . U. S. A.

the machine and provides 100 steps of fine volt-amperage adjustment within reach of the operator's hand.

The large outer control dial shown is the field rheostat which controls the differential compounds, while the remote control unit adjusts the open circuit voltage. This control is protected from accidental breakage by a metal pull-out handle set over the control dial and by cushion springs on back of the porcelain rheostat.

Oil, Electric Fires Put Out By Carbon Dioxide Engine

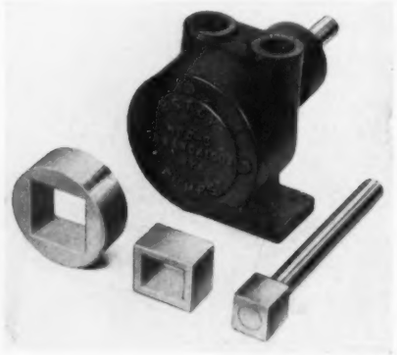
For use on both electrical and oil fires the American-LaFrance-Foamite Corp., Elmira, N. Y., has brought out a 100-lb. carbon dioxide engine. It is equipped with an Anti-Statik horn to protect the operator from static charge. A retaining latch releases the horn instantly

yet holds it firmly in place when not in use. The engine is designed for perfect balance at wheeling height and has a third swivel wheel for easy handling.

The equipment is recommended for fires in flammable liquids, alcohol storage, electrical machinery and other class B and C fires. Fire is instantly smothered with carbon dioxide gas which expands to 450 times its stored volume upon discharge. It is non-poisonous, odorless and non-corrosive.

Estey Coolant Pump Does Not Require Priming Before Use

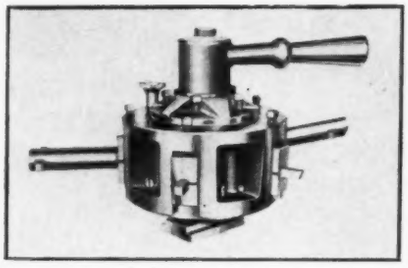
Designed to pump thin or thick coolants without the necessity of priming each time the machine is started, the Estey Pump Co., Inc., Canandaigua, N. Y., has brought out a Model C coolant pump. The equipment has only three moving parts which are so arranged that the pumping action is obtained by the equivalent of practically four pistons operating within a circular area.



The pump can be operated in either direction, and pumping action is positive. Two of the moving parts made of similar metal are separated by the third part which is of a different metal. This feature tends to reduce the friction and thus gives longer service.

Automatic Machine Lathe Turrets Have Five-Station Adjustment

A five-station oscillating toolblock lathe turret has been developed by the Automatic Machine & Tool Co., 132



Charles St., Auburndale, Mass., which is available in three sizes. The toolblocks in both top and bottom halves are interchangeable in any of the five positions in the turret head.

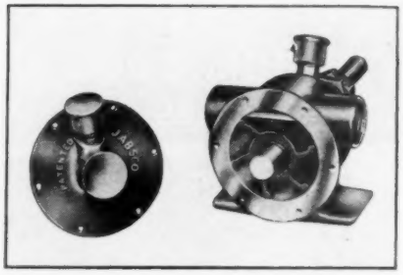
The bottom half of all the toolblocks oscillates about a tool steel hardened pin which is threaded into one-half of the turret body and slotted on the other end, permitting its removal and that of the block with extreme ease.

The cutting off tool is made to give rigid support to a standard cutting off blade and the long shank allows adjustment to various cut-offs. Ten stops are provided on the index plate which allow for ten different tool settings.

Jabsco Self-Priming Pump Meets Low Pressure Needs

Announcement of a self-priming pump with only one moving part has been made by Jabsco Pump Co., 8302 Wilshire Blvd., Beverly Hills, Calif. It pumps either thick or thin coolants and is recommended for handling coolants which may have become contaminated with abrasives. The moving part is a synthetic rubber impeller. The pumping action is positive and it does not require priming each time the machine is started. This pump is particularly adaptable to fields where pressure requirements are low. Easy installation can be made on milling machines, lathes, tappers and other machine tools. Mounted at any angle the pump can be operated in either direction. It is available in sizes ¼ to ¾ in. with capacities from 2½ to 22 gal. per min.

A 6 gal. tank, motor and pump have



been combined to make the pump into a portable coolant unit for use and attachment with lathes, grinders, drill presses, tappers, saws and milling machines.

Black Drill Hardsteel Toolbits Make Deep Cuts at Fast Speed

Hardsteel toolbits for machining tough, hard steels and copper or aluminum alloys have been introduced by the Black Drill Co., Cleveland, Ohio. These toolbits are especially suited to work on heavy forgings where deep, rough cuts may be made at faster cutting speeds, and they are also claimed to

give excellent results when used as finishing or forming tools.

The toolbits can be reground on an ordinary wheel time after time. However they require less frequent regrinding because they operate efficiently at red heat and take considerable abuse. Handsteel toolbits are made square and round from ⅛ in. up, in all of the usual sizes.

NEW MATERIALS

National Bearing Babbitt Metal Avoids Use of a High-Tin Base

A tin-saving Rex babbitt metal has been placed on the market by National Bearing Metals Corp., St. Louis, Mo., having a tensile strength of 8,200 lb. per sq. in. and Brinell hardness of 25.0. It is reported after rigid tests to be a satisfactory substitute for high tin-base babbitt.

Jessop Water-Hardening Tool Steel Has High Strength and Ductility

A water-hardening tool steel called Jessop RT has been announced by the Jessop Steel Co., Washington, Pa. It

COPYRIGHT 1942—JONES & LAUGHLIN STEEL CORPORATION

FROM AN ORIGINAL DRAWING BY ORISON MACPHERSON

STEEL WORKERS MULTIPLY PRODUCTION OF WAR-STEEL PLATES

As U. S. artillery observers spot and check accuracy of gunfire, so steel inspectors in rolling mills measure and check accuracy of war-steel plates which their fellow workers are producing white-hot in endless procession.

Thousands of skilled steel men all along the lines of America's plate mills are setting up almost unbelievable production records. They are making these records on regular plate mills and also on continuous strip-sheet mills quickly converted to meet the emergency. On the continuous mills plate production has actually been multiplied several times.

Men of the J&L mills in Cleveland and the Pittsburgh district are doing a record job of delivering steel plates in a continuous stream—for the ship-builders, for the manufacturers of tanks, guns and other fighting equipment. No time is being lost or material wasted on the steel front.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

PARTNER TO INDUSTRY IN WAR PRODUCTION

J&L STEEL

W-S Standard Reamers with carbide tips. Tapered shank (illustrated) and straight shank types. Sizes: ¼ to 1½.

STANDARD CUTTERS
available from stock

WE LIST as STANDARD many cutting tools formerly in the so-called "special" class. Better yet, the majority of these standard cutters is in stock most of the time. Our line is broad enough to often permit consolidation of tool orders thereby saving valuable time.

Cemented carbide tools are our *specialty*. We make them *exclusively*. Each tool is tipped with the *correct* grade of CARBOLOY best suited to do a cutting job on the metals for which the tool was ordered. (Other brands of carbide can be specified.)

You can expect and get uniform, high quality results with Wendt-Sonis tools. Catalog 142 mailed FREE upon request. Ask for it! WENDT-SONIS COMPANY, HANNIBAL, MISSOURI.

Wire or phone your requirements and priority rating.

W-S Carbide Tipped Core Drills available in straight and tapered shanks. Sizes: ½ to 1½.

W-S Carbide Tipped Centers available in Morse, Browne & Sharpe and Jarno Tapers.

WENDT SONIS

CARBOLOY CUTTING TOOLS

CENTERS ★ DRILLS ★ CORE DRILLS ★ COUNTERBORES ★ SPOT FACERS
END MILLS ★ REAMERS ★ HOLLOW MILLS ★ LATHE BITS ★ SPECIAL TOOLS

is said to have unusual toughness and strength and enough ductility to stretch more than 4 percent before it will break. A 1½ in. piece will have a fine grained case approximately 3/16 to ¼ in. deep with hardness of about 61-63 Rockwell "C" hardness. The smaller sizes, under ¾ in., will harden throughout.

Cerro de Pasco Offers Alloy For Proof-Casting Cavities

Cerro de Pasco Copper Corp., 40 Wall St., New York, N. Y., has developed an alloy called Cerrosafe for accurately proof-casting cavities such as molds, forging dies and gun chambers. It can be used to advantage as a filler behind delicate parts to be machined or ground in profiling or duplicating machines. Cerrosafe has been found useful also for protecting wood core molds and patterns.

The alloy is a composition of bismuth, lead, tin and cadmium and is completely molten at 190 F.

Oakite Industrial Deodorant Is Applied in Water Solution

Development of a three-purpose sanitation material called Oakite Deodorant No. 1 has been announced by Oakite Products, Inc., 24 Thames St., New York, N. Y. This material is readily made up in solution form by mixing a small quantity with water. It gives effective detergent action and disinfecting properties to the surfaces where applied and destroys many offensive odors in washrooms, locker rooms and rest rooms, etc. and leaves no odor. Grease, oil, grime and dirt can be thoroughly removed with this deodorant. It is packed in 125 and 375 lb. drums and in 45 lb. pails.

TRADE PUBLICATIONS

BORING MILLS Bulletin No. 103, published by Rogers Machine Works, Inc., Alfred, N. Y., gives the design, operation and application features of their vertical turret mills.

BROACHING MACHINES The complete line of Model "HAS" universal horizontal broaching machines is covered in detail in a 12-page folder published by Colonial Broach Co., Detroit, Mich.

CONVECTION HEATING Forced convection heating in the annealing, normalizing and hardening ranges, is described in a folder of the Lindberg Engineering Co., 2458 West Hubbard St., Chicago, Ill.

COSTS Companies dealing directly or indirectly with the Army, Navy or Procurement Division of the Treasury

Department, as contractor or subcontractor, should procure a copy of the pamphlet "Explanation of Principles for Determination of Costs Under Government Contracts" from the Superintendent of Documents, Washington, D. C., price 10 cents.

COUPLING The Precision Development Co., Salisbury, Md., has issued a pamphlet illustrating the Fast's "Flexaline" coupling.

CUTTING TOOLS Catalog 42V, published by McKenna Metals Co., 103 Lloyd Ave., Latrobe, Pa., contains line drawings and halftone illustrations and covers specifications and prices of Kennametal steel-cutting carbide tools and blanks.

DIAMOND TOOLS A four-page folder on industrial diamond tools has been issued by the Christensen Diamond Tool Co., 3683 East Willis, Detroit, Mich.

FIRE PREVENTION Copies of the booklet entitled "Preventing Cutting and Welding Fires" may be obtained from the National Fire Protection Association, 60 Batterymarch St., Boston, Mass., at a cost of 10 cents each.

FIRE PROTECTION "High Pressure" is the title of a house organ published by Walter Kidde & Co., Inc., 122 East 42 St., New York, N. Y., describing recent developments in fire protection and in the handling of compressed gases.

HEAT TRANSFER A folder describing and illustrating equipment for heat transfer is offered by the Bell & Gossett Co., Morton Grove, Ill.

MACHINING ALUMINUM A revised 48-page edition of the booklet, "Machining Alcoa Aluminum" is offered by the Aluminum Co. of America, Pittsburgh, Pa. Practices and suggestions developed in war industries are included, for both aluminum and its alloys, as distinguished from other commonly used metals.

MACHINE TOOLS "Bulldog" precision milling machines, milling machine attachments, conversion attachments for lathes, endless belt sanding machine, swing frame grinding and polishing machine and gyratory foundry riddle are described in an 8-page booklet published by Jefferson Machine Tool Co., Cincinnati, Ohio.

MAGNIFIER The Boyer-Campbell Co., 6540 Antoine St., Detroit, Mich., has issued a folder describing Supersight apparatus for giving magnification and directing light to specific operations.

MILLING MACHINES Cincinnati Milling and Grinding Machines, Inc., Cincinnati, Ohio, has amplified and reissued booklet No. M 773-1 "Milling

RECENTLY, before an important audience, two eminent machine tool authorities stated *that the intelligent study of cutting oil application may offer as much as 30% production* improvement in many plants. There are indisputable facts behind that statement!

Cutting oil application should not be a matter of "guess and hope" or habit. It need not be; for there are Stuart Oil Engineers, specialists of broad experience, skilled in solving cutting oil application problems, ready to help you.*

The Metals Exposition is a good place to start your cutting oil study. Stop in at Booth C-310.

For All Cutting Fluid Problems

D. A. STUART OIL CO.

Chicago, U.S.A. • LIMITED • Est. 1865

Warehouses in All Principal Metal Working Centers

WARTIME CEILINGS AND FLOORS

Here, again, we find Uncle Sam in a tight spot. But this is WAR!

We've heard a lot of talk about price and wage ceilings . . . and talk about floors. The Government says that price ceilings must be maintained if we are to avoid inflation. The unions want wage increases because of today's prices. Manufacturers complain that they can't make profits with a ceiling on prices and none on wages.

What is the right price for a product in wartime? What is a fair ceiling for wages? How much profit should a manufacturer make?

Actual facts are the surest guideposts toward the solution of these problems.

This is why the determination of variable costs, fixed costs, break-even point, and profit per unit above break-even point, is the sanest approach to this whole problem of wartime prices, wages and profits.

And, today, there are available to all businesses certain tools of management engineering which will help find the answers.

Geo. D. Trundle Jr.

THE TRUNDLE ENGINEERING COMPANY

Consulting Management Engineering

GENERAL OFFICES · CLEVELAND · BULKLEY BLDG.
CHICAGO · City National Bank Bldg. · 208 S. La Salle Street
NEW YORK · Graybar Building · 420 Lexington Avenue

Machine Practice". Additional information has been added for the milling of magnesium and characteristic types of milling machines and attachments have been included.

MOTOR CARE A handbook entitled "A Guide to Wartime Care of Electric Motors" has been published by Allis-Chalmers, Milwaukee, Wis.

MOTOR CONTROL A four-page booklet, offered by Cutler-Hammer, Inc., 315 N. 12 St., Milwaukee, Wis., is designed to solve the motor control problems of the training shop. It includes information on overload and undervoltage protection and manual control, as well as typical shop layout showing full magnetic control.

OIL RECLAMATION The Gale Oil Separator Co., Chrysler Bldg., New York, N. Y., offers folders describing apparatus for clarifying and reclaiming cutting oils and coolants.

PUNCH PRESSES, MILLING MACHINES Punch presses and multipurpose bench milling machines and accessories are described in a folder which is offered by the Duro Manufacturing Co., 800 East 61 St., Los Angeles, Calif.

RUBBER CONSERVATION The B. F. Goodrich Co., Akron, Ohio, has issued a catalogue section on belt vulcanizers and belt splicing tools.

RUBBER LININGS Catalog section 900 on Vulcalock rubber linings for handling corrosives and abrasives has been published by The B. F. Goodrich Co., Akron, Ohio.

SALVAGE Means of salvaging tools and machine parts by welding are pictured in a folder offered by Eutectic Welding Alloys, Inc., 40 Worth St., New York, N. Y.

SOLDERING IRONS The Hexacon Electric Co., Roselle Park, N. J., offers a circular illustrating and describing screw tip, plug tip and hatchet type electric soldering irons.

SPRAY PAINTING Production engineers, finishing foremen and others interested in speeding spray-gun operations may obtain a copy of the 15-page booklet "How to Speed Up Your Finishing Operations" from the Finishes Division, E. I. du Pont de Nemours & Co., Wilmington, Del.

STARTERS A new, 16-page bulletin describing automatic reduced voltage starters has been published by Allen-Bradley Company, 1311 S. 1 St., Milwaukee, Wis. This bulletin contains a

discussion of the factors that enter into the selection of automatic reduced voltage starters for squirrel cage motors.

TEMPERING New data and charts are contained in the revised illustrated catalog, T-625 entitled "Homo Method For Tempering," offered by the Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa.

TOOL CONTROL The advantages of their tool control machine are outlined in a 4-page folder published by the Ohmer Register Co., Dayton, Ohio.

VENTILATORS A folder on blackout ventilation systems has been published by the Ilg Ventilating Co., 2850 North Crawford Ave., Chicago, Ill.

WELDING A 20-page booklet which editorially and pictorially explains the products, manufacturing and engineering facilities, and wartime activities of the companies making up the Hobart Group of factories and contains pictures showing possible uses for products may be obtained from Hobart Brothers Co., Box EW83, Troy, Ohio.

WELDING Progressive steps in the adjustment and operation of the atomic-hydrogen electrode holder are described in bulletin No. GET-1062 recently issued by the General Electric Company, Schenectady, N. Y. The bulletin is arranged for quick reference.

NEW BOOKS

THEORY AND PRACTICE OF JOB RATING—*By M. F. Stigers, assistant professor of trade and industrial education, Purdue University, and E. G. Reed, president, Reed Laboratories, Inc.* 154 *pages. Published by McGraw-Hill Book Company,* 330 *West* 42 *St., New York, N. Y.* $1.75.

Offering an accurate practical means for measuring every job element, including the intangibles heretofore considered unmeasurable, this book will be found to be an invaluable tool for management. It provides for employers the advantages of measuring scientifically those job elements which have heretofore been too difficult to measure. It is understandable by employees, who can see how it protects their interests by substituting facts for fancy.

The system for wage calculation outlined by the authors of this book is a method of systematized reasoning for the evaluation of those things which cause differences in wage rates for individual workers, jobs and localities. They point out that: "Wage rates are correct when the incentive is just enough to attain the maximum needed production from every individual, and the wage rate is so related to other economic factors, such as capital income, that the distribution of purchasing power tends to bring about the highest possible consumption consistent

Woody Spencer says...

"HERE ARE 3 SIMPLE RULES EVERY SHOP MAN SHOULD FOLLOW"

1—Pick the RIGHT tool

2—KEEP it in condition

3—Use it CAREFULLY and INTELLIGENTLY

Sounds elementary—and it is. Yet if every mechanic followed those 3 simple rules every time he'd save lots of tools — eliminate rejects — save time, labor and expense.

Every tool and every minute of production time counts today. Think about these simple rules and follow them every second you're on the job. That's your contribution to Victory.

Let us help you select the right tap for your job?

FROM CUSTOMERS BLUEPRINTS WE QUITE FREQUENTLY MAKE RECOMMENDATIONS FOR

"THE RIGHT TAP AT THE RIGHT TIME"

The Wood & Spencer Company

Cleveland, Ohio

LUFKIN PLANER GAGE
—THE TOOL WITH 101 USES

Because of its many exclusive features, a Lufkin Master Planer Gage handles scores of jobs that cannot be handled by the ordinary planer gage.
It can be used as an adjustable parallel. It can be used with an Indicator for transferring measurements, with a Sine Bar for grinding angles, or with gage blocks to build up work on a Surface Plate. Actually there are more than 101 practical uses to which this finely made, precision tool can be profitably used.

For further facts about the Lufkin Master Planer Gage see your Distributor. Write for catalog.

LUFKIN
SAGINAW, MICHIGAN · NEW YORK CITY
TAPES · RULES · PRECISION TOOLS

with national productive capacities. Any wage system that pays more or less than the amount required to bring about economic production and distribution is wasteful.

"Where the system is fully developed within a plant, the work of each individual is analyzed on a uniform and impartial basis, the worker is shown the exact reasons for his rate, what improvement he is expected to make in his ability and performance, what increase in pay he can expect when he makes these improvements and, most important, how to improve himself. Since this procedure keeps both the job and the individual rates in line at all times, no other wage plan is required."

•

INSTRUCTION OF WELDING OPERATORS—*68 pages. Published by the American Welding Society, 33 West 39 St., New York, N. Y. 50 cents.*

The American Welding Society has approved and published a new tentative standard entitled "Code of Minimum Requirements for Instruction of Welding Operators, Part A—Arc Welding of Steel 3/16 to ¾ in. Thick." This code represents a revision of the proposed code that was issued by the society in 1941 and which was adopted and reprinted by the War Production Board for use in defining an "accredited school." The new code has been expanded, particularly with respect to the supplementary material given in the appendices as suggestions to persons organizing courses in metal arc welding. The sections in the main body of the code include: equipment and facilities of the school, qualifications and duties of the instructor, instruction in welding practice, instruction in welding theory, and final tests.

•

PRACTICAL MECHANICS HANDBOOK—*By F. J. Camm, editor of Practical Engineering. Fourth Edition. 398 pages. Published by the Chemical Publishing Company, 234 King Street, Brooklyn, N. Y.* $4.

Production and tool engineers, as well as shop mechanics, will find this handbook of practical value. While it describes English practice, almost all of the material will be found useable in shops in the United States.

The author has covered lathe operations, small tools, filing, spinning and marking out the use of the dividing head, the micrometer and the vernier, mensuration, screw cutting, gear cutting, hardening and tempering, case hardening, the chemical coloring of metals, electroplating, silver soldering, brazing, welding, soft soldering, soldering aluminum, a discussion of the metric system, pattern making, battery charging, the sharpening of woodworkers' tools, polishing and finishing metals, drawings, blueprints, weights and measures, glues, cements and ad-

hesives, and similar topics. The large number of drawings and photographs used to illustrate this book show practical tools and methods, and a number of tables are included to give helpful information. While the book is printed by the offset process and much detail is lost in the photographs, they are reproduced with sufficient clarity to illustrate the points under discussion.

•

ENGINEERING QUESTIONS AND ANSWERS, VOL. III—176 *pages. Published by Emmott & Company Ltd., 78, Palatine Road, Manchester, 20, England. Price, 6 / net.*

This third volume continues the record in permanent form of selected answers from the questions and answers section of *Mechanical World and Engineering Record*. This section has been a feature of the magazine for a number of years.

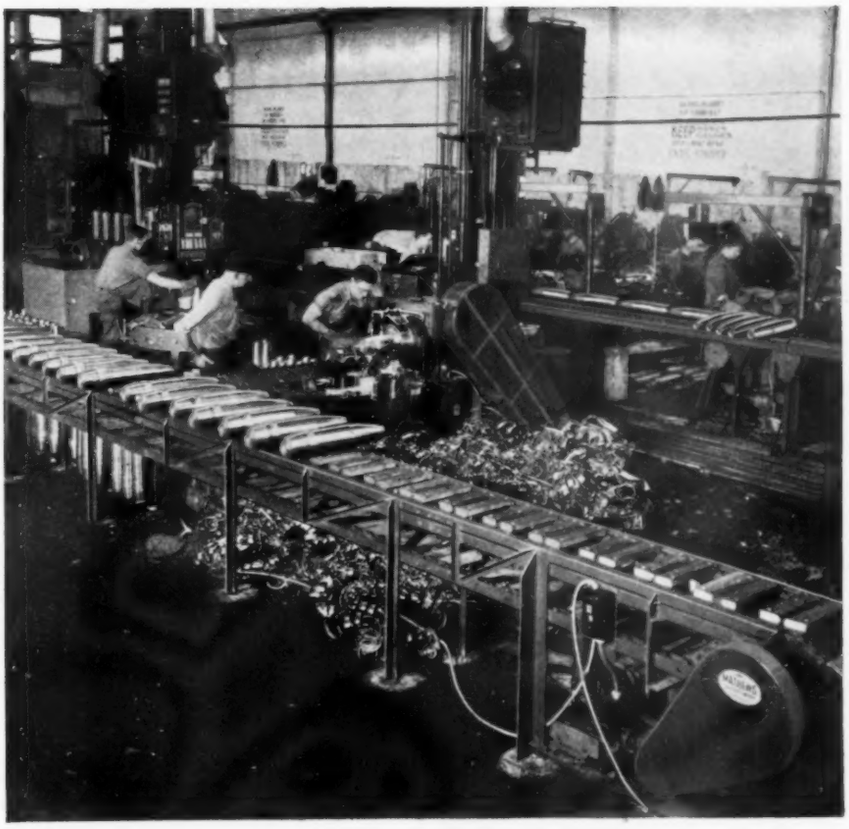
The questions and answers included in this volume cover a wide range of problems encountered by engineers in the course of their work. The problems come from many fields, including the machine shop, the design engineer's office, building construction, power engineering, water works, and others. Illustrations are included to assist in the explanation of most of the problems. In addition, to aid reference a detailed index has been included as in the first two volumes.

•

SPOT WELDING OF ALUMINUM ALLOYS—*Prepared by Committee on Aircraft Welding Standards of the American Welding Society in cooperation with the Resistance Welder Manufacturers' Association. 48 pages. Published by the American Welding Society, 33 West 39 St., New York, N. Y. $1.*

The American Welding Society has recently approved and published an emergency standard entitled "Tentative Standards and Recommended Practices and Procedures for Spot Welding Aluminum Alloys." This report is the result of nine months of work by a technical committee, and represents tentative recommendations for standards of weld quality and performance, as well as general recommendations of the best practices and procedures to be followed in spot welding of aluminum alloys in the aircraft industry.

Published in the form of a heavy paper-covered pamphlet, this report contains a general discussion of the theory of spot welding, particularly as applied to aluminum in the aircraft industry. The subjects covered include standards of weld quality, surface preparation for spot welding, methods of testing, methods of inspection, design of spot-welded parts, welding equipment and installation, as well as a short discussion of personnel requirements and production methods. The report should serve as a practical



SHELL PLANTS DEPEND ON

MATHEWS

Conveyers

● Mathews engineering hours are reserved these days for manufacturers of war materials. Makers of munitions in the United States and Canada are watching production figures rise — assisted by Mathews Conveyer Systems. Perhaps you've overlooked an opportunity to "Keep 'em Rolling" faster by not taking advantage of the experience of your Mathews Engineer. If you have, a wire or a letter will bring complete information as to how Mathews can best serve you.

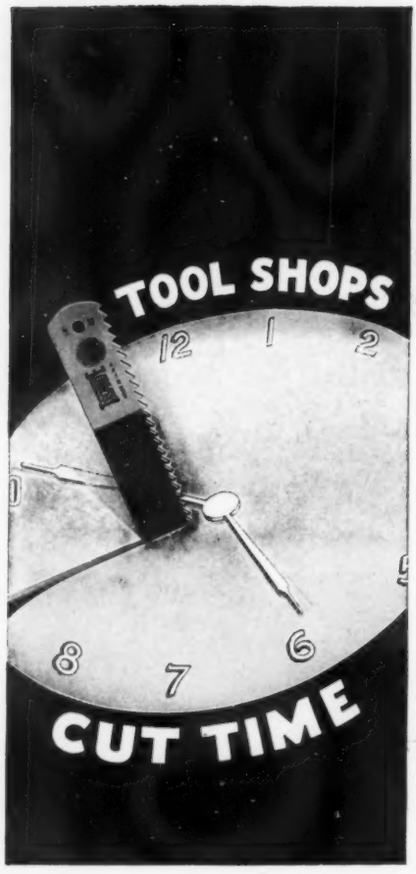
MATHEWS CONVEYER COMPANY

ELLWOOD CITY, PENNA.

Field Engineers and Sales Offices located in 30 Industrial Centers

DOUBLED CAPACITY FOR WAR PRODUCTION

Stepping up our productive capacity month after month has barely enabled us to keep pace with mounting war orders. As long as this condition exists, it becomes increasingly difficult to meet civilian requirements. Our one big job is the handling of war material. That job must come first.



SHOP A *(Penna.)* *saved one minute each cut on 2½" tool steel bars.*

Time counts for this company, because in wartime many tool orders are rushed on a production basis.

SHOP B *(Calif.)* *reports 62% more cuts.*

This small tool company is owned by a prominent consulting engineer who tested hack saw blades thoroughly before switching to Capewell's Technite.

You, too, will find they cut faster, last longer. Order from your mill supply man.

CAPEWELL

guide and reference for those engaged in spot welding aluminum alloys.

The art of spot welding, as applied to aluminum alloys, is comparatively new. Improvements and new developments are occurring rapidly, and because of this fluid condition these standards and recommended practices and procedures are intended as a temporary guide, reflecting primarily the conditions existing at the time of their publication. These data apply only to the spot-welding form of the resistance welding process as defined by the American Welding Society.

SEEN and HEARD

By JOHN R. GODFREY

TNT—Not an Explosive

If TNT is not an explosive, what is it? This question was raised in the minds of employees in a mid-west ordnance plant when placards bearing the initials appeared in literally hundreds of places throughout the shops. Their curiosity was soon satisfied when TNT was announced as the winning plant slogan selected from hundreds offered by the employees.

Today TNT is printed on placards and used as the masthead of the employees' monthly newspaper. It was selected to reflect the workers' attitude toward their jobs.

Its meaning? *Today, not tomorrow.*

It Can Be Done

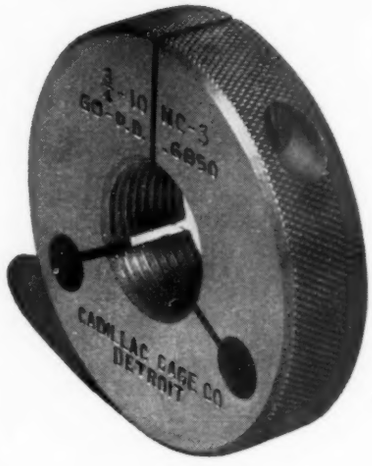
Recently a tool shop in Detroit had to get started quickly on a contract to make some tools for the assembly of large airplane parts. This shop already had one metal-cutting bandsaw, but in order to balance its capacity to get the airplane fixtures made in time another machine of the same type was needed quickly.

When the manager found that he could not get delivery on a new saw soon enough to meet his needs, he raided the shipping department and moved a woodworking bandsaw into the machine shop. A reduction gear unit was coupled to an electric motor and mounted on a floor plate near this machine to provide the low driving speed necessary for cutting steel. New guides were added and the proper saw band was installed. Within a very few hours this metal-cutting bandsaw was at work.

Specify Results—Not Methods

One great mistake made by engineers who write specifications is to tell manufacturers *how* the product is to be made. There are several reasons why this is not only foolish but unwarranted; the most important reason is that it delays production of badly needed parts for all sorts of war goods.

FOR *accuracy* CADILLAC THREAD RING GAGES



As specialists, we manufacture thread plug and ring gages for checking National, Whitworth and special form threads from your smallest size requirements to fifteen inches in diameter. Special thread checking fixtures and thread alignment gages are built to customer's design. Orders and re-orders from the largest armament manufacturers testify to the accuracy of CADILLAC Gages. *Let us serve you!!*

CADILLAC GAGE COMPANY
20316 Hoover Rd. Detroit, Mich.
★ MANUFACTURERS of
THREAD PLUG AND RING GAGES
AND OTHER THREAD CHECKING EQUIPMENT

Cadillac OF DETROIT

Specifications should only state *what* is wanted and not how it is to be made.

Parts of needed war material have been rejected because the threads were hobbed instead of being ground. There was no question as to the quality of the thread, its fit or its ability to perform perfectly. But the "specs" said the thread must be ground—so they were rejected.

Fortunately another inspector who knew that results counted, accepted the parts, and the work went on instead of being delayed while a thread grinder was being secured.

Specifying methods handicaps both production and the man who is responsible for it. Many shops do good work in unorthodox ways that the specification engineer never heard of. If the method rests with the man on the job, real production will result.

Bottlenecks

Two things that can muss up production more than anything else are unnecessarily severe specifications and inspectors who think their sole duty is to reject as many parts as possible. Of the two, the men who make the specifications are most to blame. They should know enough to allow as much tolerance as possible both as to materials and dimensions.

Inexperienced inspectors are less to blame than those who write the "specs." But they should be taught that the best inspector is the one who passes the greatest number of parts that will work satisfactorily in the completed unit.

TO THE EDITOR

Why Not Hire Older Men?

Dear Sir:

There are still industrial concerns which have a set personnel policy of refusing to hire men over 40—regardless of their training or previous experience.

I know whereof I speak. I am 47 years of age, American born, mechanical and industrial engineer with 25 years experience in factory work, from time study to standard costs. I am used to long hours in plants, foundries, steel mills, in excellent health and I still maintain my contacts in engineering work.

I have had an annuity since 1940, so I am not starving. When the war came along I prepared an outline of my qualifications, which was sent to a number of manufacturing companies. I wanted, and still want, to do my part in this war. I had a number of requests to present myself for an interview. I called at each plant. The outcome was that my age was considered as against me, being classed as an industrial personnel hazard.

I am not crabbing and am not seeking any self-pity or glorification. I am stating some plain cold facts. Industry

ROEBLING *Wires*

ROUND . . . FLAT . . . SHAPED

A FEW WIRES TYPICAL OF ROEBLING'S BROAD SPECIALTY PRODUCTION
SO MUCH MORE —So fast
WHEN YOU START WITH READY-TO-USE WIRES
FLAT WIRE TO SPECIFICATION
SHAPED WIRES
ROUND WIRE FOR ANTI-AIRCRAFT RECOIL SPRINGS

Steel that's right...specs on the nose...wire brought to the right point for final fabrication. That's the way Roebling can help you save time and speed victory production.

Wire for "flak" gun's recoil springs, for example, calls for exacting finish and dimensions, plus extremely close control of steel analysis and grain structure. So it starts with hand-tailored steel, is handled on custom-production facilities and gets the follow-thru of Roebling men who have spent their lives meeting tough specs.

If close dimensions, uniform temper, unusual shapes, or special finish is your war-order of the day . . . remember Roebling is delivering wire ready-for-production to others, is anxious and able to do the same for you.

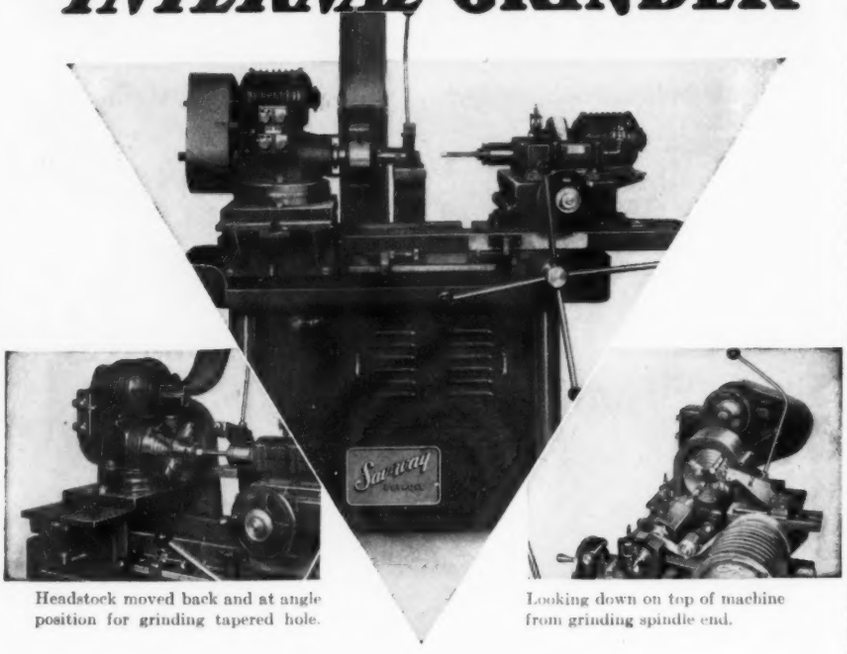
IRON AND STEEL ARE DESPERATELY NEEDED! Throw Your Scrap into the FIGHT!

JAR ROEBLING

JOHN A. ROEBLING'S SONS COMPANY

TRENTON, NEW JERSEY · Branches and Warehouses in Principal Cities

Saw-way MULTI-PURPOSE INTERNAL GRINDER



Headstock moved back and at angle position for grinding tapered hole.

Looking down on top of machine from grinding spindle end.

Offers greater flexibility . . . a precision grinder, designed and built by engineers with years of practical experience to guide them . . . has a headstock traverse of 6″ . . . grinds holes ¼″ to 18″ in diameter . . . holes up to 9″ deep, straight or tapered . . . entire headstock may be moved at right angle to wheel traverse, by merely loosening two conveniently located nuts . . . worm compensating device permits grinding wheel head adjustment to .0001 . . . sturdy construction throughout . . . full specifications, delivery time and price on request.

Distributors throughout the U. S. and Canada to serve you.

Saw-way TOOL AND MACHINING CO.
13842 JOS. CAMPAU AVE. DETROIT, MICHIGAN

seems not interested in the "over 40's."

I don't believe I am carping when I say that the government is passing up a chance for using a large number of hard thinking, common sense engineers with their feet on the ground, and who know a lot of short-cuts in production work, in foundation gained from years of experience around machinery and industrial plants.

DONALD L. KELLOGG.

Blisters on Aluminum Forgings

Dear Sir:

We were very much interested in the article on "Forging Aluminum Alloys" by Herbert Chase which appeared in a recent issue (*AM*—Vol. 86, page 491) of AMERICAN MACHINIST.

We do a certain amount of this work and are running into trouble with blisters. We understand other firms have the same trouble. So far, we have not been able to explain their appearance, nor prevent their occurrence. We thought perhaps you might be interested in learning of this phenomenon which causes much dissatisfaction among the users and accounts for an appreciable scrap loss in the plants of producers of aluminum alloy forgings. Any facts you could uncover regarding the matter would, we are sure, be appreciated by the industry.

Very truly yours,

E. B. PAYSON.
Assistant Superintendent
J. H. Williams & Company

Causes of Blisters on Aluminum

Dear Sir:

There are four principal causes of blisters in aluminum alloy forgings: (1) overheating during the forging or heat-treating operation, (2) high temperature oxidation, (3) folds during forging, and (4) porosity or other discontinuities in the forging stock.

If during the forging or heat-treating operations the stock or forging is heated above the eutectic or lowest melting temperature of the alloy, localized melting will occur, usually accompanied by the formation of blisters. The size and the distribution of the blisters will depend on the alloy, the degree of overheating and the conditions under which the overheating took place. Generally, however, overheating can be recognized by discoloration of the surface of the forging and a fairly general distribution of blisters over the entire surface. The remedy is, of course, more accurate control of forging and heat-treating temperatures.

When some aluminum alloys, particularly those containing appreciable concentrations of magnesium, are heated to high temperatures in atmospheres containing moisture or sulphur, a type of attack occurs which may result in the formation of small blisters over the entire surface of the forging. This phenomenon is discussed in a paper by Dr. P. T. Stroup, "Atmospheric Control in the Heat-Treatment

Suggestions for MORE EFFECTIVE INSPECTION PRACTICE

1 Establish a definite wear allowance for all fixed size gages, plugs, rings, etc.

2 Check these gages periodically to determine when wear has eliminated this allowance.

3 In final inspection it is better to use an instrument than a fixed size gage when the wear allowance of the gage by the 5-10% rule is established at .0001″ or less. Here the human factor is usually important enough to outweigh the effect of the wear allowance and gaging results become questionable.

4 It is ordinarily not best to use a conventional snap gage for the inspection of work having a manufacturing tolerance of .002″ or less.

5 Keep plugs and rings oiled when not in use.

6 Be sure that both work and gage are clean before they are brought together.

7 Periodically check your precision gage blocks for wear, against a set of certified blocks. Redesignate them when wear is revealed.

8 In setting a comparator gage be sure that both gage and precision blocks are at the same temperature.

9 It is well to check the calibration of indicating type comparators periodically. If an error is found, it is better to send the comparator back to the factory for recalibration.

10 If you are using Multichek gages insist on the operators handling them smoothly. Work should never be jammed violently into gaging position.

Sheffield Engineers

are authorities on precision inspection. Get their advice on questions relative to gaging and Dimensional Control.

SHEFFIELD GAGES
MASTER GAGEMAKERS

THE SHEFFIELD CORPORATION
DAYTON, OHIO, U. S. A.

★

YOUR PROBLEM *Different?*

BUT Ross Valves have been designed for and used in literally hundreds of diversified plants . . . Ross engineers and mechanics have a fund of specialized knowledge that is freely at your disposal . . . If you have some specially different problem of air control, Ross technicians will help you solve it. Bring your air control problems to Ross.

ROSS *Operating* **VALVE CO.**

6489 Epworth Boulevard

DETROIT, MICHIGAN

of Aluminum Products," appearing in a book entitled "Controlled Atmospheres," published by the American Society for Metals, Cleveland, Ohio. The most satisfactory remedy for this type of blistering is control of heat-treating conditions so that absence of moisture and sulphur is insured. As indicated in the above reference, protective atmospheres may be established in the presence of small concentrations of moisture and sulphur by the use of special protective compounds in the furnace.

Sometimes during the forging operation portions of the metal may be folded back on itself, entrapping air. Upon heat-treatment, the expansion of the air and the low strength of the metal at the heat-treating temperature may result in the formation of blisters. This type of blistering is usually quite localized, and is readily eliminated by changing the flow of metal in the forging dies.

An infrequent cause of blisters in forging is porosity, laps, folds or other discontinuities in the forging stock. Such discontinuities may originate in porosity in the original ingot or during operations incidental to the fabrication of the forging stock. The remedy for this type of blistering is the use of only sound ingots and in proper fabrication and inspection procedures in the production of stock to be used in making forgings.

These are the principal sources of blisters in forging, and of the four, it is our experience that by far most of the trouble encountered by commercial forging producers results from overheating. Metallographic examination of forging and stock will usually permit accurate classification of the type of blistering involved in any specific instance.

Very truly yours,

L. W. KEMPF,

Aluminum Research Laboratories,

Aluminum Company of America.

Synthetic Fuel in Germany

Dear Sir:

Two factors make it less likely that Hitler will be stopped by lack of engine fuel than is popularly believed. The first is the development in Germany of synthetic oil and substitutes, which are vital in that country because of limited oil supplies but which, of course, are not considered in any discussions of engine fuels in the United States because of our great reserves. The second is the remarkable development of the diesel engine in that country.

On my last visit to Germany, I had the opportunity to investigate the production of diesel engines and fuels. Thousands of diesel engines were being constructed in Germany even then —for installation in tanks, trucks, tractors, trains and airplanes. This application of the diesel engine to the German war machine has resulted in a tremendous saving of fuel—and has

upset the calculations of many "experts."

By the beginning of 1939 a tax of 51 cents a gallon had been imposed in Italy on gasoline and a 36 cent tax in Germany. The reason was to encourage the development of synthetic and substitute fuels. There were also direct subsidies. At that time, about a quarter of all motor vehicles in the Axis countries used synthetic or substitute fuels.

Gasoline made from coal gases was widely used. Alcohol made from vegetables was blended with straight gasoline. There were experiments with ammonia and acetylene. Some 25,000 vehicles in Europe used compressed gases as fuel.

Other substitutes for gasoline and oil are oil made by hydrogenation, pulverized coal suspended in oil and oil "cooked" from corn, wood, algae, seaweed, leaves and similar substances in combination with limestone.

Very truly yours,

B. B. WILLIAMS, *President*
Cooper-Bessemer Corporation

Tire Tools Reclaimed

By NOAH DEERING

High-speed steel tools used to recut flanges on locomotive tires and car wheels are purchased in an annealed condition with the shape of the flange machined on the tool. Usually both ends are prepared in this manner. After hardening, the correct flange contour is maintained by grinding the top of the tool. Continued grinding ultimately thins and weakens the tool.

Naturally the first thought was to anneal and remachine new flange contours on the tool. However, it was found difficult to anneal them properly with the limited equipment we had in our shop. It was finally accomplished by placing the tools in a container made from a 26-in. length of standard-weight 6-in. pipe, one end of which was closed permanently by welding thereto a piece of ¼-in. boiler plate. A few inches of spent charcoal were placed in this metal tube, and the form tools were laid on the charcoal. Care was taken to prevent the tools from touching either each other or the sides of the tube. When the tools were in place, the tube was packed with spent charcoal, and a piece of ¼-in. boiler plate tack-welded in place to close the container.

This was placed in a furnace and allowed to heat at 1,500 F. for two hours., after which the temperature was dropped to 1,350 F. and held for six hours. The furnace was then shut down and the container left therein until it had attained room temperature. The entire procedure required 40 hours.

The tools were then removed, machined, hardened and reground. This practice permits us to save these cutters, rather than scrapping them or working them down for single-point cutting tools.

A peacetime accomplishment now speeds **VICTORY**

BEFORE the war . . . when business existed or perished on production efficiency and consistent quality, Wyckoff Cold Drawn Steels established themselves as leaders in precision, accuracy, and uniformity.

Today when *absolute maximum production* must be coupled with durability and dependability in such vital weapons as tanks, ships, guns, and planes . . . these same properties of Wyckoff Cold Drawn Steels are doing a Commando's job for America and the United Nations' War Industries.

We fly the Army-Navy "E" Flag as a symbol of achievement and as an ever-heightening goal for greater production.

Photo by U. S. Army Signal Corps

WYCKOFF
DRAWN STEEL COMPANY
FIRST NATIONAL BANK BLDG., PITTSBURGH, PA.
3200 SO. KEDZIE AVENUE, CHICAGO, ILL.

Manufacturers of Carbon and Alloy Steels . . . Turned and Polished Shafting . . . Turned and Ground Shafting . . . Wide Flats up to 12"x2"

Announcing...

A New Wartime *Idea Service* for Industrial Advertisers

Surely everyone engaged in industrial advertising recognizes that the war effort can be and is being helped by speeding essential information from where it is to where it is needed. It's now a matter of each individual advertiser deciding "How?" and "Where?".

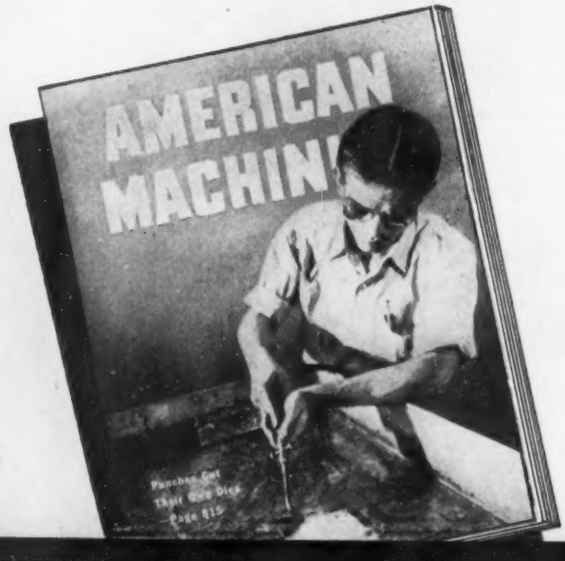
Some of the best brains in the business, in plants and agencies all over the country, are hard at work finding the correct answers to these questions. And out of this mass of concerted thinking are coming many successful and sound advertising policies.

The impact of the war program came early to Metal-Working, enormously expanding the need for tools, equipment and supplies. Long before Pearl Harbor many *American Machinist* advertisers swung into wartime copy. They have had time to "shake down" their advertising to meet present needs, and many excellent campaigns have resulted.

So — as a helpful service to our advertisers, and to advertising as a whole, we are bringing you a series of reports based on this wealth of experience. This monthly "AD-NALYSIS" will be a digest of some of the current *American Machinist* ads that are helping the war effort.

They may give you some ideas and can serve as comparisons to check your own strategy. They will form, in effect, an "idea pool". . . made by and for today's industrial advertisers.

It is our hope that manufacturers' executives responsible for advertising policies, and account executives, copy chiefs and other agency heads who have a voice in determining advertising themes, will find in this monthly "AD-NALYSIS" a source of practical ad-building material.



A McGRAW-HILL PUBLICATION

ABC 330 W. 42nd St., New York ABP

Circulation now over 22,000 net paid, Metal-Working's largest by several thousands, covering the buying power of over 90% of the industry, in which virtually all armament is made. Fortnightly readers estimated at well over 100,000. Advertising page-gain for first six months of '42 greater than that of any other publication of any type.

TOPS IN METAL-WORKING FOR 65 YEARS

AMERICAN MACHINIST

AD-NALYSIS

How Advertisers Are Currently Using Helpful, Informative Messages in American Machinist to Reach Production Executives of War-Busy Metal-Working

No. 1

V-Belts Vital to Victory

Based on the premise that one of today's big jobs is to help industry get longer life out of V-Belts, this ad unselfishly gives advice to all users . . . whether they use this particular company's products or not. In a series of nine practical points, the manufacturer gives "Life-Saving Hints" on V-Belt conservation to help safeguard the "Lifelines of power." Hints include how to install, proper tension and alignment, replacements, etc. Certainly a worthwhile theme . . . one that is enhancing the company's reputation for service and building for the future. Ad is a 2-color page, with small sketches illustrating points.

Multiplying Milling Machine Range and Capacity

Only those with top priority can get delivery on new milling machines. So this 2-page, 1-color ad features "Standard Attachments and Accessories That Multiply the Range and Productive Capacity of Your ———— Milling Machines." Pictured and described are 4 attachments to help solve tooling problems. Thus a definite service is rendered to those who want to adapt present equipment to new uses. The ad also carries on the long-pull story of quality and service which the manufacturer has featured in a consistent campaign.

How Coolants Lick Tough Machining Jobs

A 2-page, 2-color insert serving a multiple purpose. Page 1 gives specific solutions, through a "Job, Problem, Result" technique, of difficult cooling jobs faced by war products manufacturers. Page 2 features the company's hydraulic fluid, lubricating oil and rust preventive . . . telling how each can solve production problems. Thus the insert does a compact job of presenting a complete service to industry.

Tool Holders Save Critical High Speed Steel

Another ad in a consistent series of black-and-white pages. Main theme is the saving in high speed steel effected through the use of these tool holders . . . which utilize small "tool bits" of high speed steel instead of having the whole tool made of the precious material. Secondary theme tells how the product speeds production. Next ad in the series tells how "Today's apprentice can outproduce yesterday's 'forged tool' machinist."

Practical Improvements on Turret Lathe Operation

Production gets another boost through this latest in a series of 2-color pages describing prize-winning ideas from real-life lathe operators. Ad describes how to save time by eliminating an indexing operation. Operator who submitted idea is shown at his lathe; also shown is a close-up of the ingenious tool arrangement. This lathe manufacturer is thus helping customers get more work out of installed equipment. At the same time he is building goodwill and earning gratitude from users that will pay dividends for years to come.

Conserving Stainless Steel... Speeding Production

A 2-page, black-and-white ad giving lots of practical advice. With a general block of copy developing the need of conservation and production, rest of ad is broken into units telling specifically how to do it by checking scrap losses, physicals, fabricating speeds and rejects. Handy "slide chart" is offered, giving answers to questions on grades of stainless steel. This ad is the latest in a constructive series helping Metal-Working solve wartime materials problems. Readers will remember this in post-war days.

TO AMERICAN MACHINIST READERS: The above advertisement appeared in the September issue of Industrial Marketing and was reprinted and mailed to Metal-Working advertisers. This illustrates one of the ways in which American Machinist is constantly working to make the entire publication, advertising as well as editorial, of maximum usefulness to you. We're trying to save your time, and speed your efforts, by encouraging advertising that gives practical information to help solve your daily problems. We will appreciate your comments or suggestions as to the type of advertising you'd like to see in American Machinist.

POP'S ON THE WAR-PATH AGAINST WAR-WORK WASTE

THERE GOES A BLISTERING FOR SOMEBUDDY! ... POP'S DISKIVVERED A SWELL NICHOLSON SHEAR TOOTH FILE PUFFECTLY RUINED ON A FOUNDRY CASTING JOB..
THAT'S THE SECOND WAR DANCE THE OL' MAN'S PUT ON TUHDAY. THIS AYAM HE CAUGHT JO GLUB SCUFFIN' THE DAYLIGHTS OUT OF THE TEETH OF A BRAND-NEW NICHOLSON BY RAMMIN' IT INTO A KIT OF TOOLS LIKE HE WAS HEAVIN' SCRAP IRON ...
POP HAS ABOUT AS MUCH RESPECK FER A DRIP WHO'S CARELESS WITH TOOLS AS A SKUNK HAS FOR HUMAN DIGNITY!

LET'S GO! U.S.A. KEEP 'EM FLYING

INDUSTRIAL man-hours were never so precious — maximum production was never more urgent than now.

Tools are still one of the most troublesome "bottlenecks." There is still too much waste of tool life through *improper use, improper care* and *improper selection.*

No tools are more exposed to these life-shortening abuses than files — especially in the hands of today's many new and partly trained workers.

Shop superintendents and foremen can save valuable time, improve efficiency, reduce rejects and material wastage, through an educational drive on *the right use of files — the right care of files* — and *The right file for the job.*

Nicholson and your mill-supply house can help you on all three counts. Nicholson is more than a manufacturer of files for every purpose (over 3000 kinds, cuts and sizes). Nicholson is an authority to whom you can bring your filing problems freely.

FREE LITERATURE **on fundamentals of filing.**

FREE TECHNICAL BULLETINS **on special files for Stainless Steel, Aluminum, Brass, Plastics, Die Castings, Foundry Castings, Die Making; Shear Tooth, Lathe filing. Name ones wanted.**

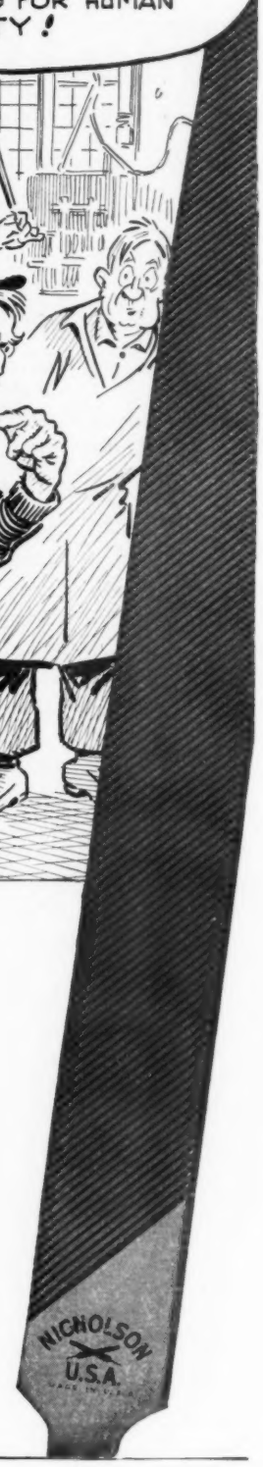
FREE WALL CHART **on regular file shapes, sizes and cut coarsenesses.**

SHEAR TOOTH FILE *(right)* — one of the Nicholson or Black Diamond "specialists." For rapid soft-metal removal *plus* smooth finishing. The combination of coarse single cut and long angle helps the Shear Tooth to clear itself of chips—minimizes clogging. Coarseness provides fast cutting; long angle gives shearing or "shaving" cut. Flat, Square, Half Round — all sizes — through your mill-supply house.

NICHOLSON FILE CO., PROVIDENCE, R. I., U. S. A.

(Also Canadian Plant, Port Hope, Ont.)

TWELVE PERFECT FILES IN EVERY DOZEN

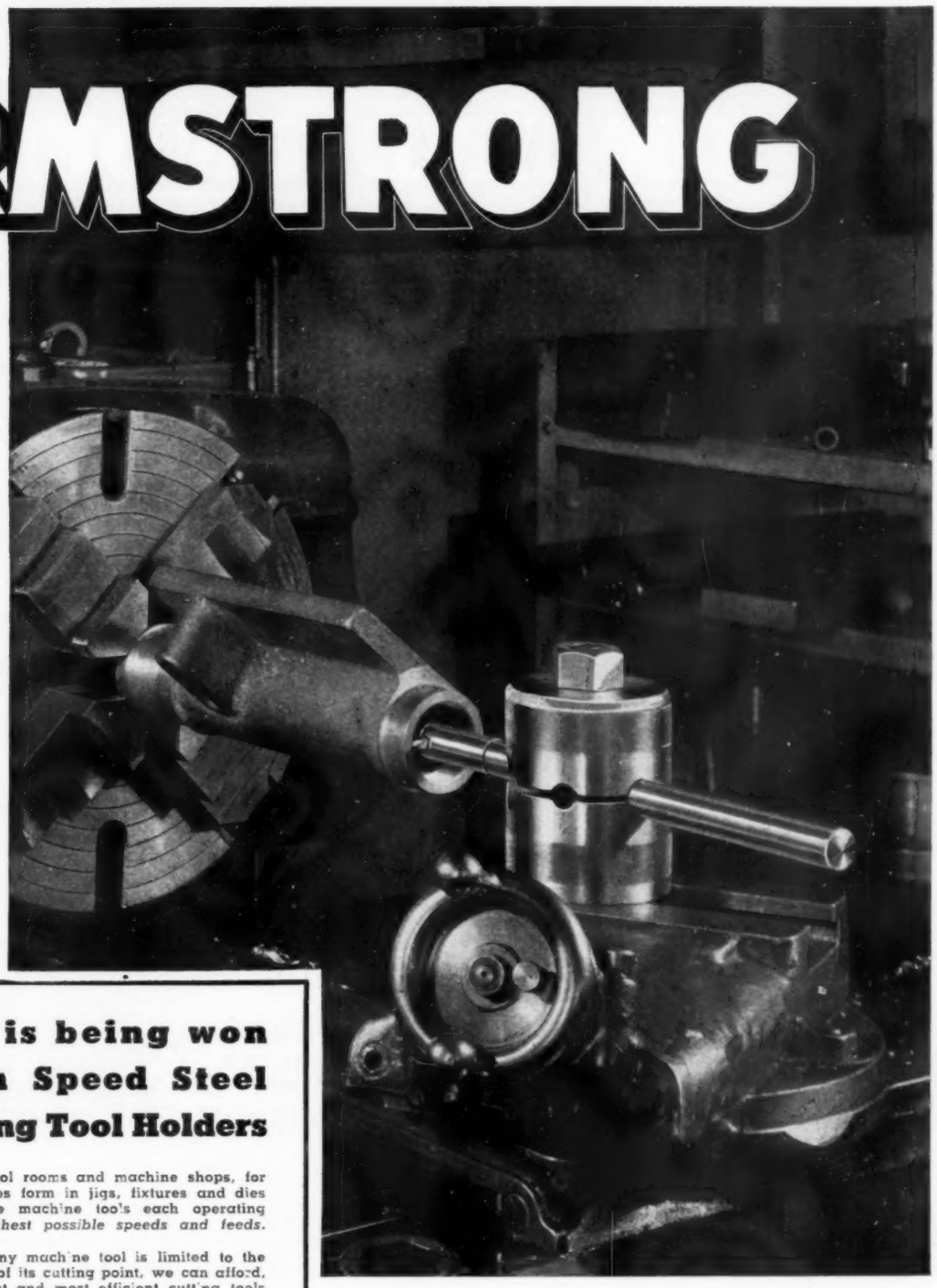


NICHOLSON FILES

FOR EVERY PURPOSE

NICHOLSON U.S.A. MADE IN U. S. A.

ARMSTRONG



This war is being won with High Speed Steel in Armstrong Tool Holders

Victory begins in the tool rooms and machine shops, for striking power first takes form in jigs, fixtures and dies . . . in more and more machine tools each operating continuously at the *highest possible speeds and feeds.*

Since the capacity of any machine tool is limited to the efficiency and capacity of its cutting point, we can afford, today, only the strongest and most efficient cutting tools with the finest cutting edge. This means, for all general lathes, planers, slotters and shapers and for many screw machine and turrent lathes, the correct ARMSTRONG TOOL HOLDER with a cutter bit of *high speed steel.*

With high speed steel so essential to top efficiency, so widely needed and with our national supply so difficult to maintain, to waste high speed steel in forged tools is to delay victory because the same high speed steel consumed in one forged tool would supply high speed steel cutters for 10 ARMSTRONG TOOL HOLDERS—would go 10 times as far, would do 10 operations instead of one, would machine 10 times as many dies or jigs. Use ARMSTRONG TOOL HOLDERS wherever possible to "Save: All Forging, 70% Grinding and 90% *High Speed Steel.*" This war is being won right now in jigs and fixtures—with *High Speed Steel* in the ARMSTRONG TOOL HOLDERS used in over 96% of the machine shops and tool rooms.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
315 N. FRANCISCO AVE. CHICAGO, U. S. A.

Eastern Warehouse & Sales:
199 Lafayette St., New York

Buy ARMSTRONG TOOLS from your Supply House

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms

McKAY ELECTRODES SERVE SAFELY

ON AND UNDER THE SEVEN SEAS!

Down in the belly of a sub . . . with countless tons of crushing water between men and the blue sky . . . *safety* takes on a new meaning!

For the tiniest flaw could spell disaster when pressure skyrockets as the ship descends.

Aware of the grave responsibility imposed on arc welds, McKay Shielded-Arc Electrodes are made with a maximum of skill and care, and inspected with never-relaxing vigilance.

Here, as in other vital phases of war time marine construction, the advantages of the McKay "Researched Line" are demonstrated daily . . . advantages destined to make welding a safer, better, easier, cheaper production and construction method later.

THE McKAY COMPANY · PITTSBURGH, PA.

PACIFIC COAST SALES OFFICES: 125 S. Santa Fe Ave., Los Angeles · 100 Howard St., San Francisco

The McKay line includes regular carbon steel, stainless, and alloy steel electrodes for every welding purpose. Literature on request.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

★ The McKay Company was among the first honored with the coveted Navy "E" award for excellence in fulfilling Naval Ordnance contracts. ★

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

McKAY WELDING ELECTRODES

AND INDUSTRIAL, MARINE AND AUTOMOTIVE CHAINS

Now You Have

19 Sources of Supply for Phillips Recessed Head Screws

AMERICAN SCREW COMPANY
Providence, Rhode Island

THE BRISTOL COMPANY
Waterbury, Connecticut

CENTRAL SCREW COMPANY
Chicago, Illinois

CHANDLER PRODUCTS CORP.
Cleveland, Ohio

CONTINENTAL SCREW COMPANY
New Bedford, Massachusetts

THE CORBIN SCREW CORPORATION
New Britain, Connecticut

INTERNATIONAL SCREW COMPANY
Detroit, Michigan

THE LAMSON & SESSIONS COMPANY
Cleveland, Ohio

THE NATIONAL SCREW & MFG. CO.
Cleveland, Ohio

NEW ENGLAND SCREW COMPANY
Keene, New Hampshire

THE CHARLES PARKER COMPANY
Meriden, Connecticut

PARKER-KALON CORPORATION
New York, New York

PAWTUCKET SCREW COMPANY
Pawtucket, Rhode Island

PHEOLL MANUFACTURING COMPANY
Chicago, Illinois

RUSSELL, BURDSALL & WARD
BOLT & NUT COMPANY
Port Chester, New York

SCOVILL MANUFACTURING CO.
Waterbury, Connecticut

SHAKEPROOF INC.
Chicago, Illinois

THE SOUTHINGTON HARDWARE MFG. CO.
Southington, Connecticut

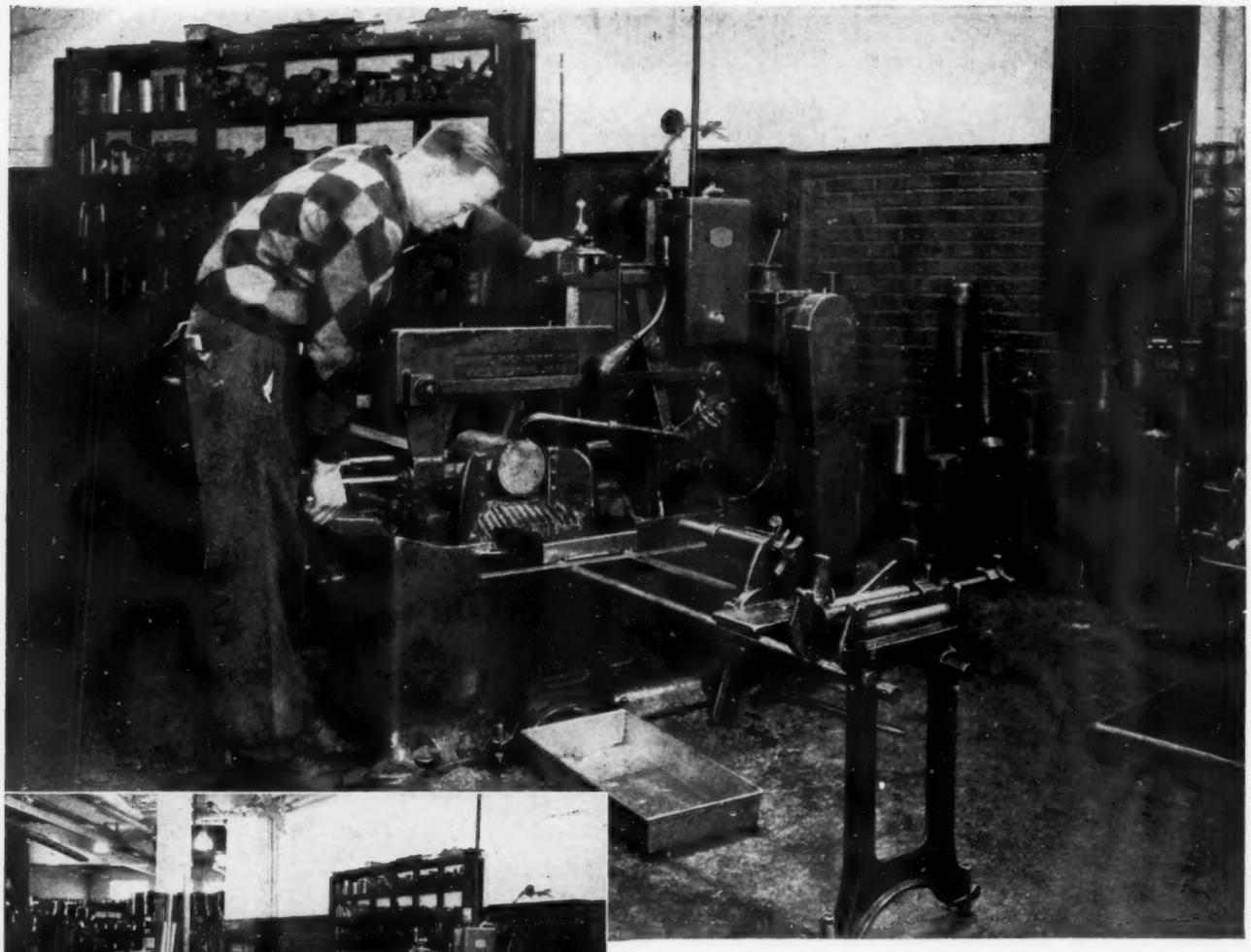
WHITNEY SCREW CORPORATION
Nashua, New Hampshire

Your screw requirements can be met without delay — with genuine fast-starting, quick-driving, tight-seating Phillips Recessed Head Screws. ***WHAT ABOUT DRIVERS?*** There are 44 sources of supply for PHILLIPS DRIVERS plus general hardware and mill supply distribution.

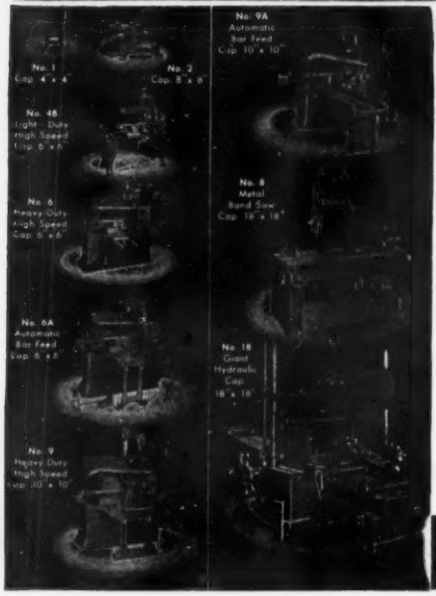
PHILLIPS RECESSED HEAD SCREWS

GIVE YOU *2 for 1* **(*SPEED AT LOWER COST*)**

WOOD SCREWS • MACHINE SCREWS • SHEET METAL SCREWS • STOVE BOLTS
SPECIAL THREAD-CUTTING SCREWS • SCREWS WITH LOCK WASHERS



MARVEL SAWS



Cutting-off continuously at high speed at Wright Aeronautical Corporation.

These MARVEL PRODUCTION SAWS at the Wright Aeronautical Corporation, Paterson, N. J., have operated continuously; have been cutting-off "round and square stock, all kinds of alloy steel up to 10" D, and 10" Sq. and giving A-1 satisfaction."

When photographed, the MARVEL 9A was cutting-off S.A.E. 3140 Steel Tubing, 3⅛" O.D. x 1⅞" I.D. at the rate of a piece every minute and a half, while the MARVEL 6A was cutting a slice from a 5½" D. Cold Rolled Steel bar every six minutes. These heavy duty all ball-bearing saws with automatic bar push-up, will cut-off more pieces, floor-to-floor, than any other cutting-off machine or method.

ARMSTRONG-BLUM MFG. CO. *"The Hack Saw People"*
3700 Bloomingdale Ave., Chicago, U.S.A. Eastern Sales: 225 Lafayette St., N.Y.

YOUR PLANT IS FIGHTING AMERICA'S WAR

Keep it rolling

CALL MASBACK

IF YOUR PRODUCTION LINE IS THREATENED BY ANY SHORTAGE OF SUPPLIES

Today's vital need for efficient production calls for speedy means of procurement plus intelligent handling and shipping of materials. Our Industrial Division is supplying Factories, Railroads, Shipyards, Contractors, Utilities, Government and Municipal Agencies as well as others engaged in manufacturing.

Our large warehouse stocks and close manufacturer relationships make it possible for us to deliver thousands of industrial supply items promptly.

Efficiency of service in procurement of INDUSTRIAL SUPPLIES is a major MASBACK contribution toward *your* part in our all-out Victory Program.

INDUSTRIAL DIVISION

MASBACK HARDWARE COMPANY

INCORPORATED

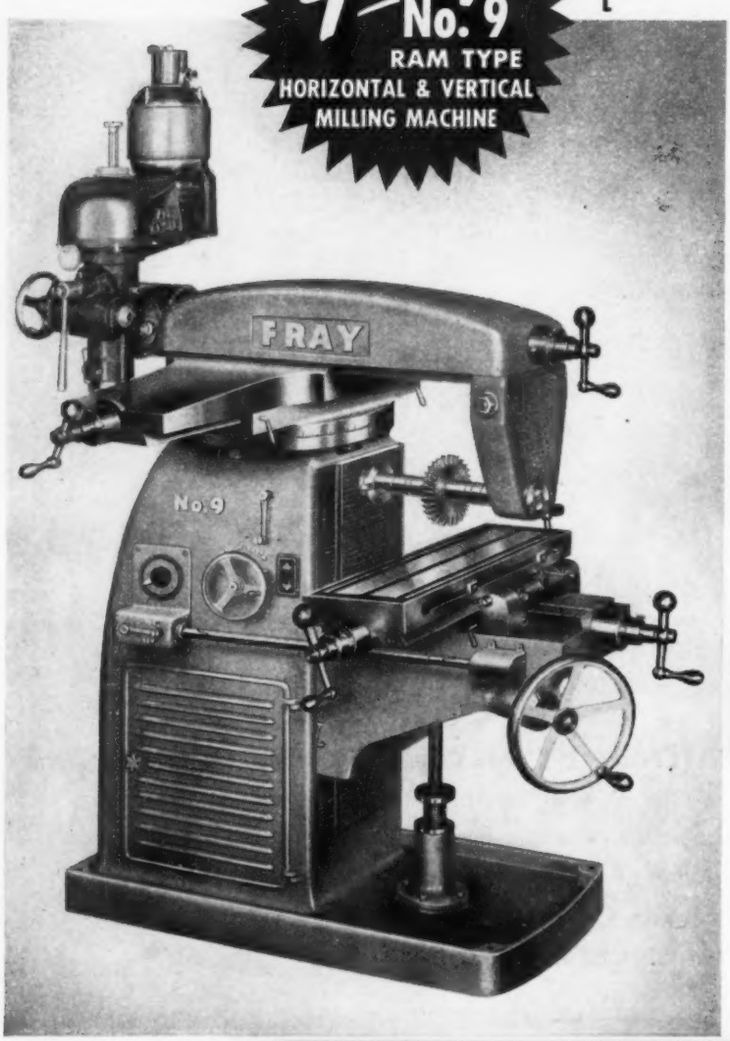
326-338 HUDSON STREET • NEW YORK, N. Y.

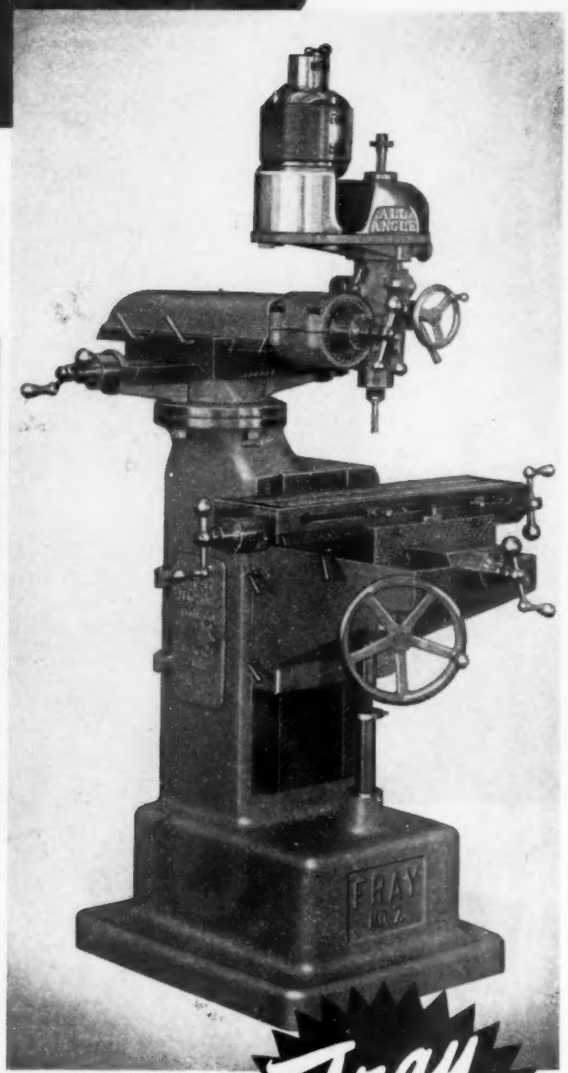
TWO VITAL TOOLS
for speeding war production

Featuring ALL THE FLEXIBILITY OF A RUBBER HOSE *plus* EXTREME RIGIDITY & UNEQUALLED RANGE

VERTICAL HORIZONTAL

Fray No. 9
RAM TYPE
HORIZONTAL & VERTICAL
MILLING MACHINE





Fray No. 7-B
RAM TYPE
VERTICAL
MILLING MACHINE

all-angle

★ *Write for descriptive literature on either or both machines*

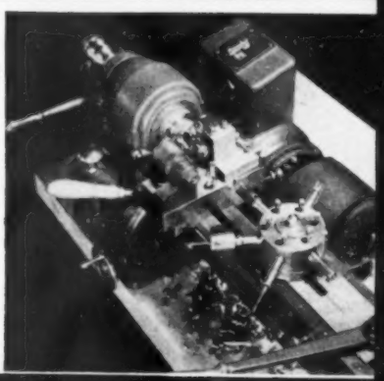
FRAY MACHINE TOOL COMPANY
517 W. WINDSOR • GLENDALE, CALIFORNIA

"Stark"

Integral Drive

PRECISION BENCH LATHE

A new stream-liner incorporating all the old Stark accuracy and stamina

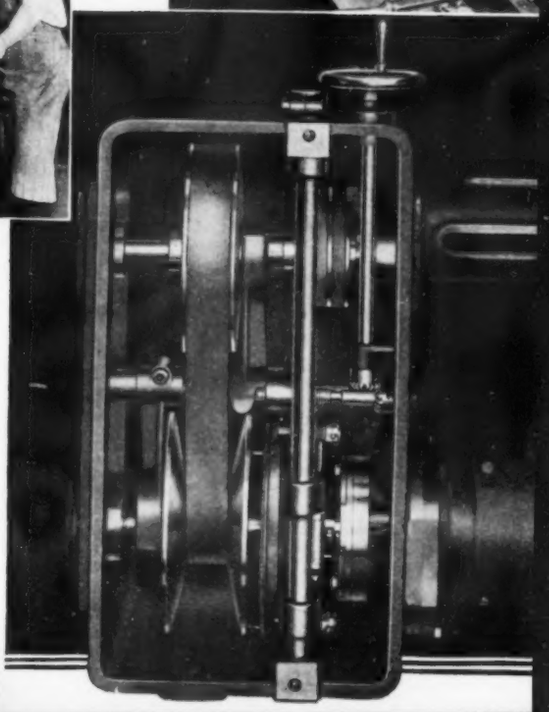


THE first tool of its class with built-in Motor and speed changing mechanism (patented). Marvelously compact: nothing under the bench, no special bench or cabinet needed, even bolting down unnecessary:

Simply moving control lever to right engages the clutch, vertical position releases, moving to the left instantly brakes the moving spindle.

Standard (tool room) model has time-tried double taper spindle bearings 156 to 2200 r.p.m.—the best for sustained accuracy.

High Speed (manufacturing) Model fitted with best precision pre-loaded anti-friction bearings, 260 to 3500 r.p.m.



Both have 40 inch bed, 9 inch swing, 20 inches between centers, either ¾ or 1 inch collet capacity. Take regular STARK Attachments collets and chucks.

This Stark (patented) built-in drive, integral with the Lathe itself, employs a ½ h.p. geared ball-bearing motor driving through a disc clutch, and through V belts to the headstock, giving any split speed at the turn of the small hand wheel in front of operator.

Write for full information

STARK TOOL COMPANY

WALTHAM, MASS., U. S. A.

ESTABLISHED 1862

ORIGINATORS OF THE AMERICAN BENCH LATHE

Model 3616

Maximum Diameter Spur Gears	36"
Maximum Diameter Helical Gears	27"
Min. Cent. Line Work & Hob Arbors	3"
Maximum Hob Diameter	8"
Diameter Work Table	24"
Diameter Index Gear	26"
Rated Max. Dia. Pitch	3"
Floor Space, inc. door swing	54" x 160"
Weight	18,000 lb.

36" DIAMETER 16" TRAVEL 20" LONG

THE CLEVELAND HOBBING MACHINE CO.
CLEVELAND · OHIO

GIDDINGS & LEWIS
MACHINE TOOL COMPANY
ESTABLISHED 1859

WE HAVE BEEN HONORED WITH THIS

Symbol

Presentation MADE SEPTEMBER 17th, 1942

OF PRODUCTION *Excellence*

THE boys out on the firing line face the enemy with but one thought—VICTORY. Such is the reward they seek. They are not concerned about earning medals—personal glory is not the thing that flashes through their minds as they valiantly carry on.

Here back of the line but in hand to hand effort wtih our boys, Industrial America is daily showing its patriotism and its determination to aid in bringing victory to the allied nations.

We are a unit in that effort.

Long ago the call came for more and more G&L High Power Precision Horizontal Boring, Drilling and Milling Machines — there was immediate need for G&L's in plants from coast to coast — these were the tools that would give added speed to America's armament production.

At the call we responded — every employee in the company took upon himself a new responsibility — personal gain was not the objective. Our employees, like the men in our armed forces, do not look for medals — it is the will to produce in bigger and better fashion that activates this whole big organization.

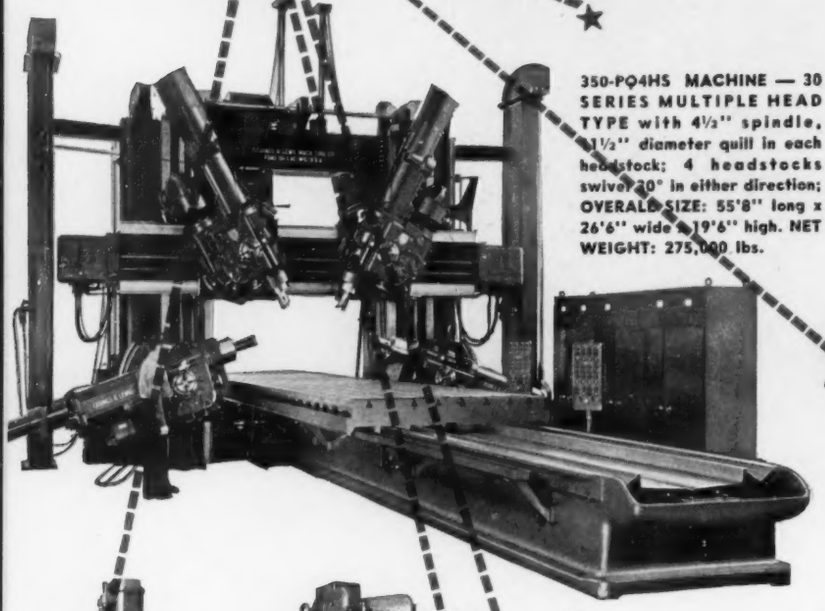
Our reward right along has been to see the number of G&L's that go into service and the job they are doing.

Now we are recipients of the Army-Navy Production Award of which we are more than proud. Not only does the "E" flag fly over our plant, but the "E" badge is worn by every member of our force. All credit to these men and women who have backed Uncle Sam with noble effort and will continue to do so as long as there is a Victory job to do.

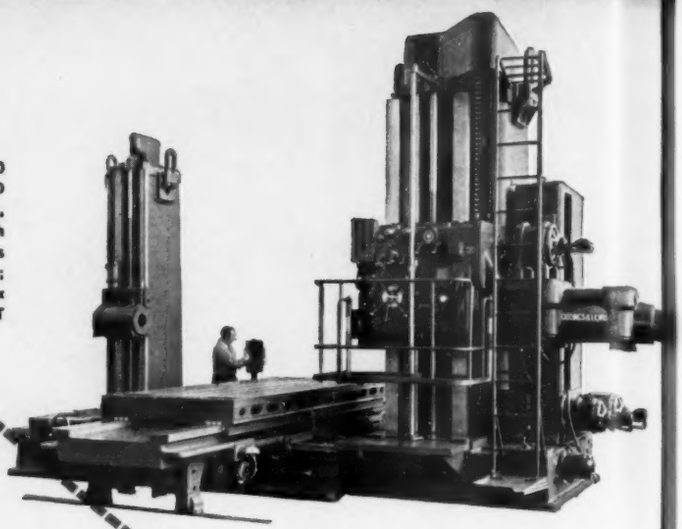
GIDDINGS & LEWIS MACHINE TOOL CO.

Fond du Lac, Wisconsin

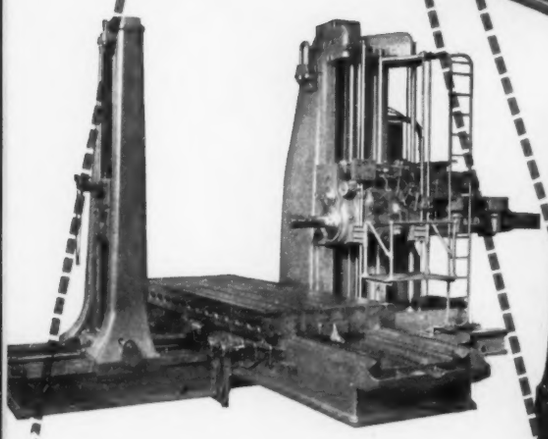
HORIZONTALS FOR DEFENSE



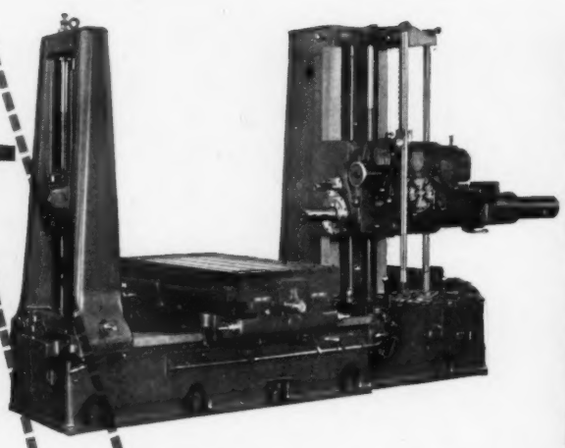
350-PQ4HS MACHINE — 30 SERIES MULTIPLE HEAD TYPE with 4½" spindle, 1½" diameter quill in each headstock; 4 headstocks swivel 30° in either direction; OVERALL SIZE: 55'8" long x 26'6" wide x 19'6" high. NET WEIGHT: 275,000 lbs.



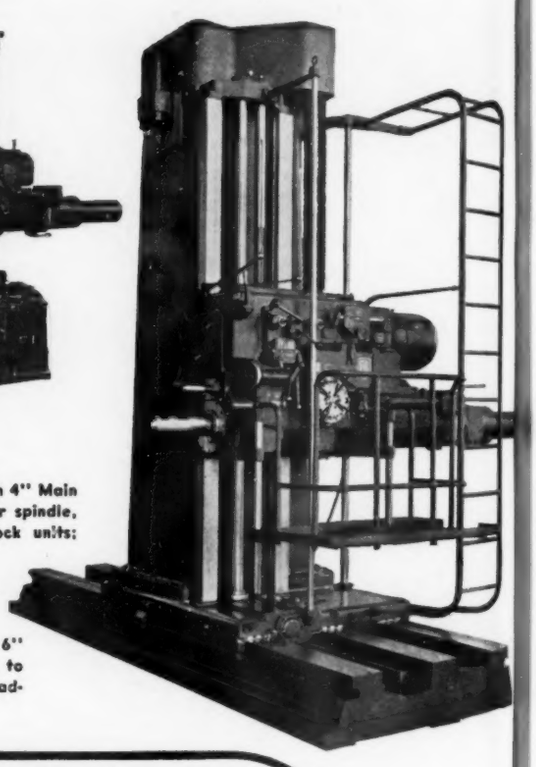
560-T MACHINE—50 SERIES TABLE TYPE with 6" main spindle, 2½" auxiliary spindle; 45 speeds to either spindle, 21 distinct independent feeds to Table Saddle and headstock units; NET WEIGHT: 140,000 lbs.



780-P MACHINE: 70 SERIES PLANER TYPE with 8" main spindle, 3½" auxiliary spindle; 36 speeds to either spindle; 18 feeds to table, headstock and column units, NET WEIGHT: 200,000 lbs.



340-T MACHINE—30 SERIES TABLE TYPE with 4" Main spindle, 2" auxiliary spindle; 36 speeds to either spindle, 18 milling feeds to table, saddle and headstock units; NET WEIGHT: 125,000 lbs.



360-F MACHINE—30 SERIES FLOOR TYPE with 6" main spindle, 2" auxiliary spindle; 36 speeds to each spindle; 18 milling feeds to column and headstock units; NET WEIGHT: 50,000 lbs.

Largest Manufacturers of Horizontal Boring, Drilling and Milling Machines in a complete line of Table, Floor, Planer and Multiple Head Types.

We make machines with spindle diameters from 2½ inches to 8 inches inclusive

GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

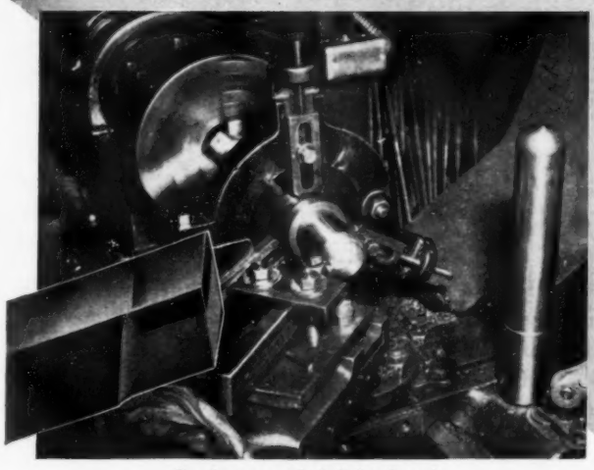
5-METHOD COMPLETE TOOL SERVICE for MAXIMUM PRODUCTION

Vascoloy RAMET

5 4 3 2 STANDARD TOOLS 1 CEMENTED CARBIDE

Small Shop Converts to War Work Using Method One

Turning gun parts at high speed using style 11 carbide tipped tool.



Turning nose of shell forging plug using modified style 15 tool.

The conversion of this small shop to the production of shell and gun parts is a typical example of the application of Method One of the Vascoloy - Ramet Complete Tool Service. In using Method One this shop uses some standard tools as they are furnished and also modifies others.

With all the standard tools available in Method One, and the almost countless number of modifications possible, this method offers the easiest way to tool up for the majority of boring, turning and facing operations on aluminum, cast iron, and steels. The standard tool most closely meeting requirements is withdrawn from stock and used as it is or modified by grinding to the desired shape. Simplified tooling practice recommends this Method One wherever possible.

For fast tooling, keep in stock a supply of Vascoloy-Ramet standard tools. Catalogue VR-421 will help you to select the standard tools you should have. Write for your copy.

Ramet

VASCOLOY-RAMET CORPORATION

NORTH CHICAGO, ILLINOIS

DISTRICT SALES AND SERVICE IN PRINCIPAL CITIES

IN CANADA: Carbide Tool & Die Company, Ltd., Hamilton, Ont.

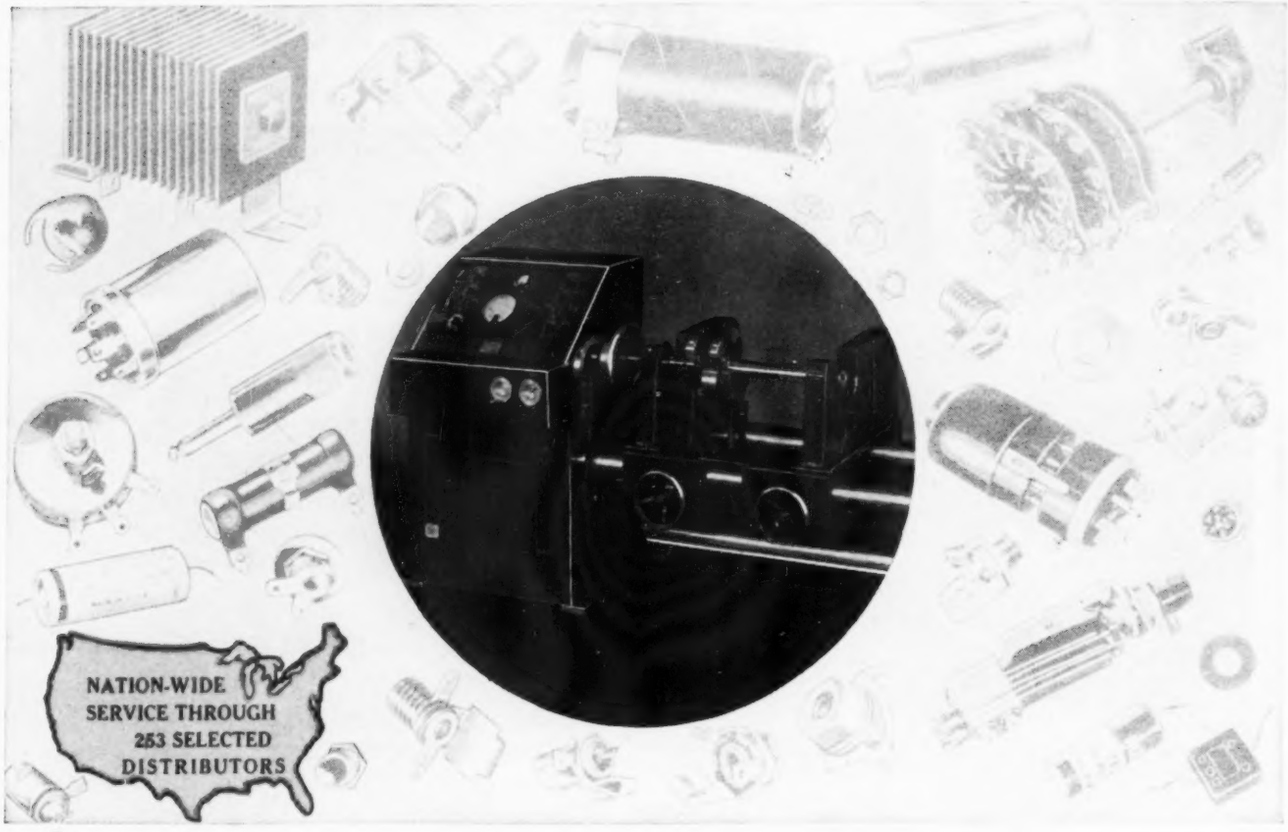
4260

TANTALUM-TUNGSTEN CARBIDE

FOR TOOL SERVICE..... *Specify* Vascoloy RAMET TOOLS

TANTUNG "G"

Aircraft Engines Get Their Balance of Power . . . Thanks to Mallory Approved Precision Products



Balancing crankshafts of airplane engines assures longer motor life and less vibration . . . makes fighter planes easier to handle in the air. Thus many airplane engine manufacturers are using Gisholt Dynetric Balancing Machines to help attain more perfect operation and a smoother flow of power from the multi-horsepower engines they make.

Balancing machines made by Gisholt also improve the performance of many other products . . . from tiny motor armatures and small ventilating fans to heavy turbine rotors . . . used in many industries. To control these Dynetric Balancers, ultra-precise electronic parts are needed . . . such parts as the electrical switches supplied by Mallory.

Similarly, a large manufacturer of aircraft engines for both American and British warplanes utilizes many Dynamometer engine test cells . . . equipped with standard Mallory jack switches . . . a Mallory Approved Precision Product obtained in quantity, promptly, through the local Mallory Distributor.

Do you need electronic hardware, condensers, rectifiers, resistors or volume controls? For testing or experimental work? Or perhaps for plane replacements? Or as an integral part of some electrically operated device you plan to manufacture? See your nearest Mallory Distributor.

There are 253 Mallory Distributors from coast to coast, carefully selected by Mallory, technically trained and ready to give *your* needs their prompt attention. Ask your Mallory Distributor, or write to us, for your free copy of the Mallory catalog . . . used as a buying guide every day in the aeronautical, automotive, electrical, geophysical, radio and other industries.

Write today for free catalog covering entire line of Mallory Approved Precision Products.

P. R. MALLORY & CO. Inc.
MALLORY
APPROVED
PRECISION PRODUCTS

P. R. MALLORY & CO., Inc. **INDIANAPOLIS, INDIANA** • *Cable Address*—PELMALLO

Gulf aids to greater war production

GULF CUTTING OILS

are helping war industries get greater production, longer tool life, and better finishes on the work.

GULF QUENCHING OILS

Better physical properties are obtained in many types of steel by quenching in Gulf Super-Quench, new dual-action quenching oil.

GULF QUALITY LUBRICANTS

afford an extra margin of protection to vital equipment, resulting in less down-time and greater production.

GULF PERIODIC CONSULTATION SERVICE

provides both builders and operators of machinery a year-round engineering service on the most approved methods of application for all types of petroleum products.

Gulf quality petroleum products and Gulf Periodic Consultation Service are proven aids to greater war production—proven by outstanding results in plants manufacturing all types of war equipment and materiel.

If *you* have a production or maintenance problem which can possibly be solved by the use of the proper petroleum product, let Gulf's diversified experience and manufacturing technique go to work for you. Get in touch today with your nearby Gulf lubrication service engineer. His analysis of your specific problems and engineering recommendations will help you obtain full capacity output from every machine, a minimum of machine stoppages, and other worth-while benefits.

The services of a Gulf engineer—and the Gulf line of petroleum products for every purpose—are available to you through 1200 warehouses located in 30 states from Maine to New Mexico. Write or 'phone your nearest Gulf office today.

GULF OIL CORPORATION · GULF REFINING COMPANY · PITTSBURGH, PA.

GULF INDUSTRIAL LUBRICATION

SEE DEMONSTRATION OF GULF SUPER-QUENCH AND GULF CUTTING OILS AT THE METAL SHOW — BOOTH NO. A-329

Visit Space D-111 at National Metal Congress

National need bears heavily now on one material, now on another, for the uses of wartime industry. In the *National Emergency Steels* that have lately been developed, Molybdenum plays an important part. As to the availability and usefulness of Molybdenum, Tungsten, and Boron, correspondence is invited by the Molybdenum Corporation of America.* Printed matter is offered.

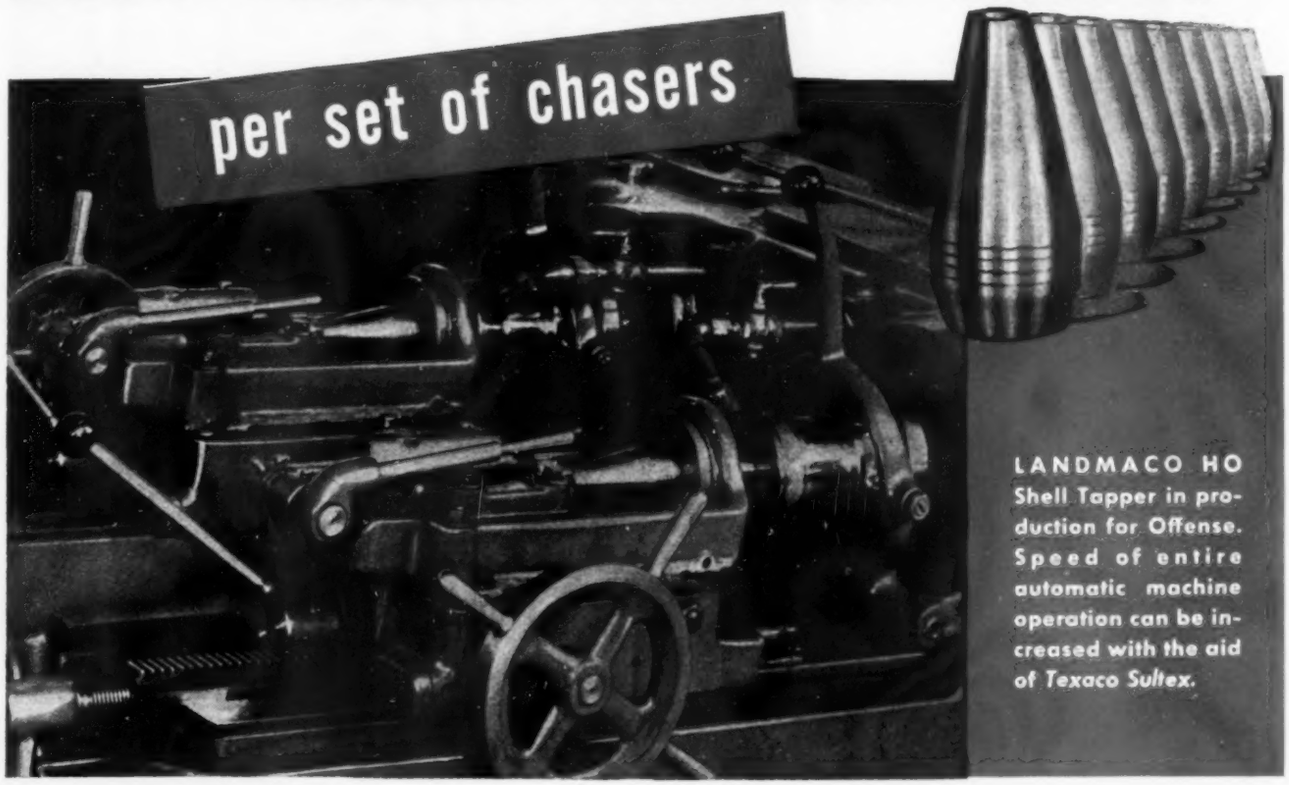
AMERICAN Production, American Distribution, American Control—Completely Integrated.
Offices: Pittsburgh, New York, Chicago, Detroit, Los Angeles, San Francisco, Seattle.
Sales Representatives: Edgar L. Fink, Detroit; H. C. Donaldson & Co., Los Angeles, San Francisco, Seattle.

MOLYBDENUM

CORPORATION OF AMERICA

GRANT BUILDING, PITTSBURGH, PA.

8300 TRENCH MORTAR BOMBS


per set of chasers
LANDMACO HO Shell Tapper in production for Offense. Speed of entire automatic machine operation can be increased with the aid of Texaco Sultex.

Producing trench mortar bombs at high speed, a well-known war plant taps 600 to 700 bombs per tool grind, averages 8300 bombs per set of thread chasers. The cutting oil responsible for these results is *Texaco Sultex.*

On many war jobs, *Texaco Sultex Cutting Oils* are increasing output, lengthening tool life, decreasing down-time, improving finish.

The outstanding performance that has made Texaco preferred in the fields listed in the panel has made it preferred by prominent users in the metal cutting field.

Texaco users enjoy many benefits that can also be yours. A Texaco Engineer specializing in cutting coolants will gladly cooperate . . . just phone the nearest of more than 2300 Texaco distributing points in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York, N. Y.

THEY PREFER TEXACO

★ More revenue airline miles in the U. S. are flown with Texaco than with any other brand.

★ More buses, more bus lines and more bus-miles are lubricated with Texaco than with any other brand.

★ More stationary Diesel horsepower in the U. S. is lubricated with Texaco than with any other brand.

★ More Diesel horsepower on streamlined trains in the U. S. is lubricated with Texaco than with all other brands combined.

★ More locomotives and cars in the U. S. are lubricated with Texaco than with any other brand.

TUNE IN FRED ALLEN EVERY SUNDAY NIGHT—CBS

TEXACO

TEXACO Cutting and Soluble Oils
FOR THE METAL-WORKING INDUSTRY

HELP WIN THE WAR BY RETURNING EMPTY DRUMS PROMPTLY

IMPACT!

The terrific "kick" of these high-powered guns is transmitted through the entire supporting structure. It takes rugged strength—the *predictable* strength of flawless welds to withstand these continuous shocks and strains.

In gun mounts, as well as in many of the other vital implements of war which defend America, welds made by P&H Alloy Electrodes are serving all along the front lines.

P&H also makes a full line of alloy electrodes for resistance to wear and abrasion, for hard surfacing, alloy casting reclamation, etc. The complete line answers every welding need, including the welding of armor-plate, stainless steels, etc. Write for informative data.

P&H FOR ALLOY ELECTRODES

P&H-HANSEN SQUARE FRAME WELDERS

—make welding simpler with but one adjustment for any desired current on both single or multiple units. Dual Mounted Units provide instant parallel hook-up to meet any requirements from 30 to 450 amperes. Ask for Bulletin W-28.

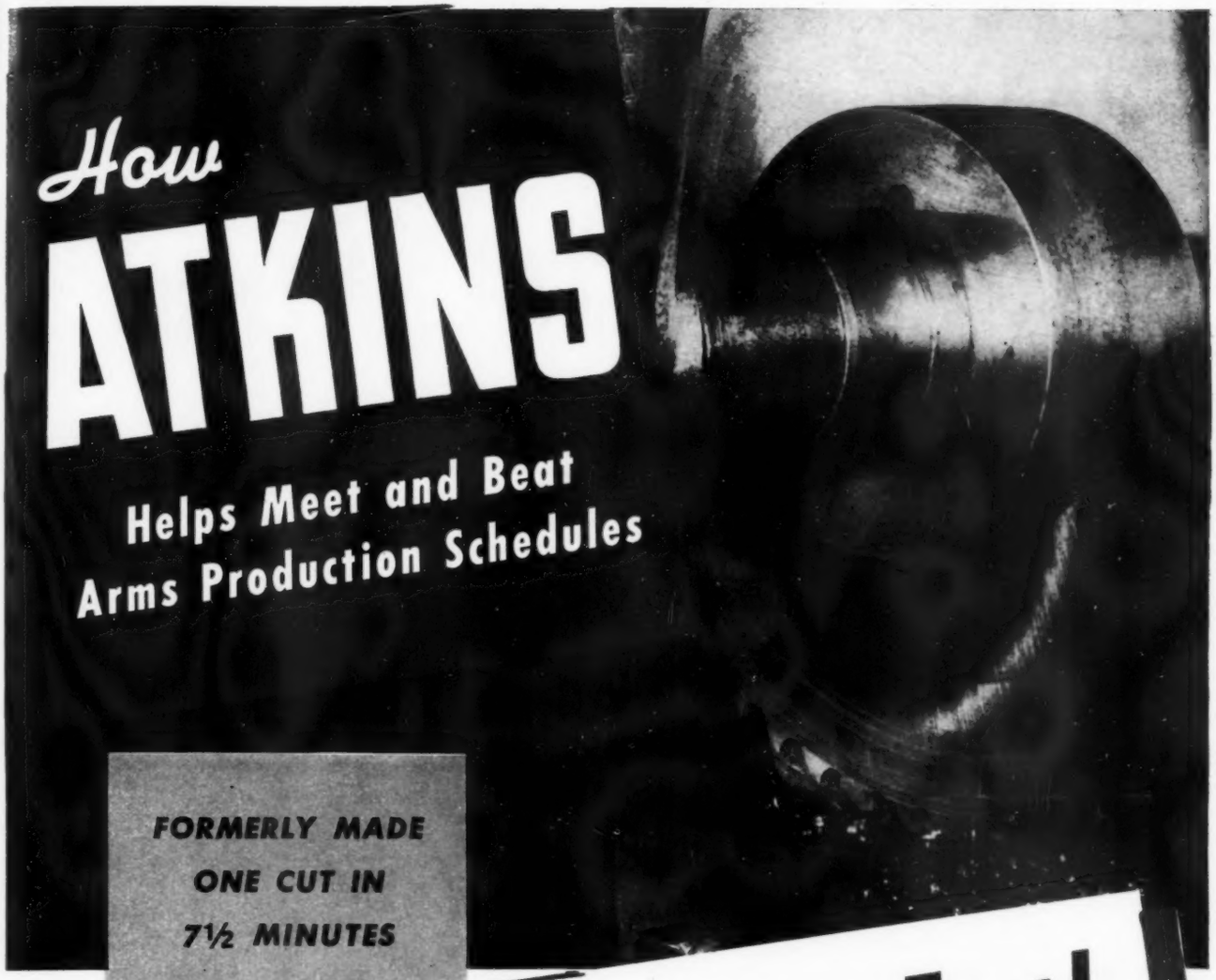
General Offices: 4514 W. National Ave., Milwaukee, Wis.

Awarded the Navy "E" for excellence in war production, P&H displays it also as a pledge of future effort.

HARNISCHFEGER CORPORATION

WELDING ELECTRODES • MOTORS • HOISTS P&H ELECTRIC CRANES • ARC WELDERS • EXCAVATORS

Canadian Distribution: **THE CANADIAN FAIRBANKS-MORSE COMPANY, LTD.**



How ATKINS

Helps Meet and Beat Arms Production Schedules

FORMERLY MADE ONE CUT IN 7½ MINUTES

NOW CUTTING 45 Times as Fast!

TIME NOW SLASHED to 10 Seconds

That remarkable increase in cutting speed occurred on a job requiring the cutting of slots in electric cast steel arm brackets for army tanks. The saw was a 6" diameter Atkins Curled-Chip High Speed Milling Saw, equipped with the special 3-dowel Atkins drive. Upon the recommendation of the Atkins engineer, the saw was run clockwise, to cut up instead of down on the material (in contrast to previous practice on the job). This, plus the tremendous cutting speeds made possible by the recently-developed Curled-Chip tooth with its huge-sized inward-curving gullet, permitted cutting rates to be increased 45 times the former rate!

● The staggering performance of Atkins Curled-Chip Saws reported here shows the great possibilities for stepping up production by getting the right saw on the right job—and using that saw in the right way. With maximum production so vital to the whole arms program, plant men will be wise to question present performance on every job involving metal sawing. In shop after shop, the amazing records hung up by Atkins Curled-Chip Saws prove conclusively that former cutting standards can no longer be accepted as a measure of saw output.

To help you find out whether you are securing maximum production, call on Atkins for unbiased engineering aid. Without obligation, an Atkins engineer will investigate your cutting problems and tell you what can be done in the way of saving time and labor and reducing machine downtime on sawing operations.

E. C. ATKINS AND COMPANY, Indianapolis, Indiana

Originators of the Curled Chip **SYSTEM OF METAL CUTTING**

MORE WAR WORK WANTED

-SHEET-METAL WORK
-STAMPINGS
-SUB-ASSEMBLIES

Take advantage of Continental Can Company's resources, facilities and organization that are now helping many industries solve their war production problems.

TODAY WE ARE PRODUCING WAR MATERIAL as prime and sub-contractors in many of our plants throughout the country. The manufacture of war items by mass production methods is made to order for our plants and personnel. Here is where our 37 years' experience in making metal containers works to advantage. We have recently prepared a portfolio showing the highlights of how our experience and organization are fitted for war work. We will be glad to send a representative to review it with you.

Here is what we offer:

▶ 45 plants conveniently located from coast to coast.

▶ 7,738,500 square feet of floor space, part of which is available for additional war work.

▶ 16,000 workers (including machinists, engineers, draftsmen, tool and die makers) skilled in mass production of metal units.

▶ A competent sales staff operating out of 27 local sales offices which expedited the handling of an annual business in 1941 amounting to $136,652,016.

▶ A War Products Council organized to give you quick action . . . to help you or tell you promptly what you want to know about Continental's ability to handle any job. Write, wire or phone War Products Council, Continental Can Company, 100 East 42nd Street, New York City, or any sales office.

NOTE: *Continental is still turning out "packages to protect America" —cans to carry needed food to our armed forces, to our Allies, and into American homes. We will continue to make these cans—as well as other containers for essential products as defined by WPB.*

CONTINENTAL CAN COMPANY

100 EAST 42nd STREET, NEW YORK CITY

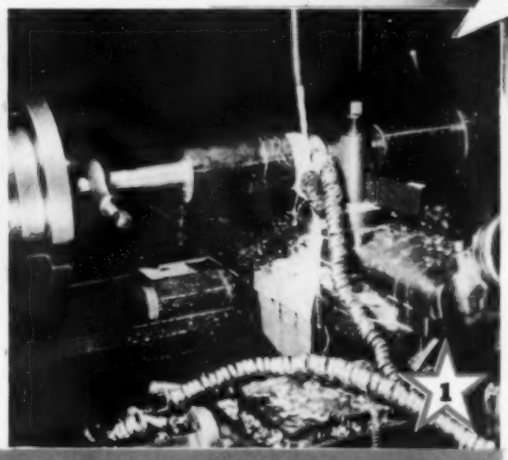
Sales Offices in:

BALTIMORE, MD. CHICAGO, ILL. CINCINNATI, O. DENVER, COL. DETROIT, MICH. HOUSTON, TEX. JACKSONVILLE, FLA. JERSEY CITY, N. J. KANSAS CITY, MO. LOS ANGELES, CAL. MALDEN, MASS. MEMPHIS, TENN. NASHVILLE, TENN. NEW ORLEANS, LA. OMAHA, NEB. PASSAIC, N. J. PHILADELPHIA, PA. ST. LOUIS, MO. ST. PAUL, MINN. SAN ANTONIO, TEX. SAN FRANCISCO, CAL. SEATTLE, WASH. SYRACUSE, N. Y. WHEELING, W. VA. WILKES-BARRE, PA.

How P&W builds Accuracy into Small Tools at Every Stage of Production

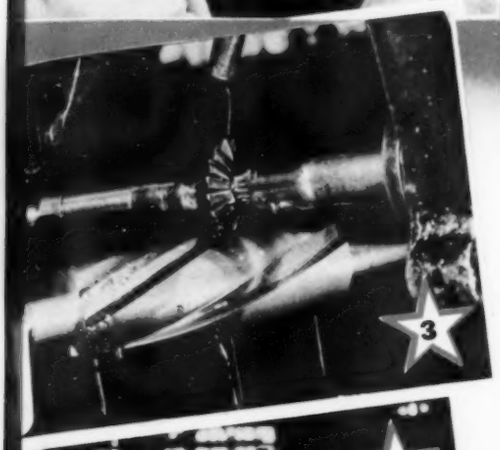
(Condensed from current issue of P&W "Backgrounds")

A STAR IS BORN



Let's follow a P&W Taper Reamer through the high-spots of its progress from raw bar stock to an efficient, accurate production tool.

Analyzed by our own metallurgists to make sure it meets our specifications, a steel bar is sawed off, centered, and 1 put into one of our own latest-type P&W lathes, where shank, pilot and cutting surfaces are roughed out. Notice the lathe's cam-lock spindle nose—envy of every operator using an older machine.

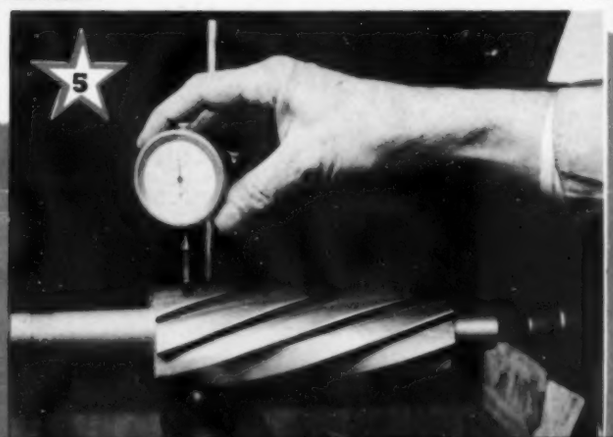


2 Shaped blank then gets a "soft inspection." Inspector here checks the O.D.

3 Back to the machines. Here a miller makes the primary fluting cuts. When a thorough check right here on the job satisfies the operator that everything's OK so far, another cutter replaces this one, and the work gets its secondary fluting cuts, which provide necessary chip room, but still leave proper support behind the cutting edge.

4 "Soft inspection" again. Here the inspector checks the relief angle with the reamer in a special gaging fixture designed by P&W for our own use. Only with such a device as this can these helical jobs be checked with the kind of accuracy it takes to satisfy P&W.

5 Checking for run-out. Reamer is then stamped with the tool number and taper figures in the shallow marking recess in the shank. Hardening begins here. Preheated to the first faint flush of red, it goes through a high-heat salt bath.

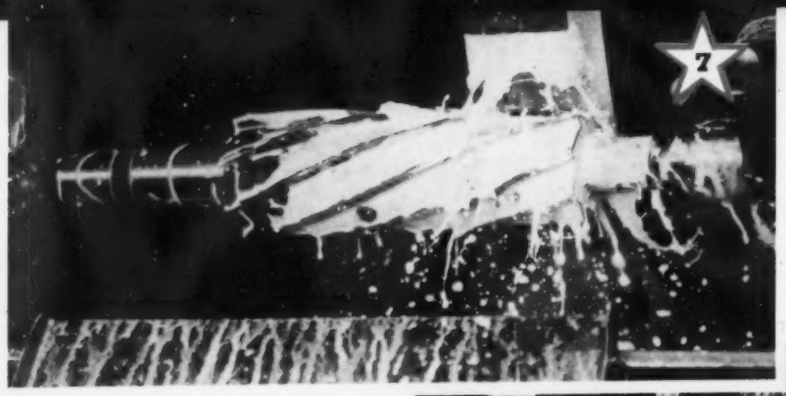


6 Incandescent, it's quenched in another hot salt bath, then air-cooled to room temperature, cleaned in boiling water to remove any remaining salt, and straightened if need be.

OVER ★★

A STAR IS BORN

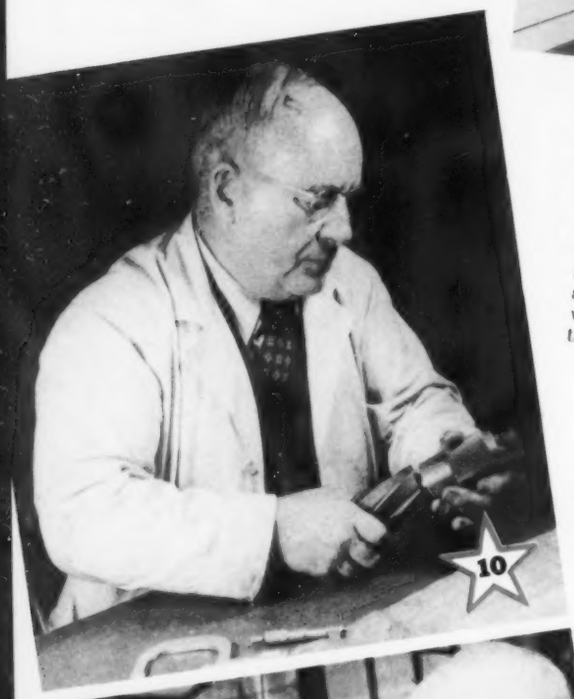
(continued from preceding page)



7 After tempering, reamer is checked for hardness on Rockwell machines. If size or shape makes machine-testing impractical, P&W file-tests against standard pieces of known hardness. Using special files as gages, experienced P&W men can check within one point of what the machines would show. **7** Now the long grind begins. Cutting edges of this reamer are to be in two planes — parallel to its axis and converging with it. Straight portion of O. D. has been ground and checked to "tenths"; tapered portion of the O. D. now feels the broad wheel.

8 Another check, P&W Small Tools Inspection Chief Louis Barrett doing the work. Normally the grinder operator would do this to determine the exact setting of his machine to produce the required taper. Hoke-block-and-sine-bar set-up provides the most accurate taper check *anywhere*.

9 After pilot and flute grinding comes relief-grinding, another operation where P&W "know-how" is invaluable to our customers. The O. D. of all cutting edges has been carefully established and the cutting face carefully trued. Now this operation accurately grinds the proper primary and secondary relief angles, following the taper and leaving just a hairbreadth of full O. D. land for cutting. When the reamer goes into service, these relief angles will let it cut *right*. When eventually it is dulled, they will permit sharpening without disturbing the accurate taper, and retaining full cutting qualities. But *you don't have to know all this* . . . you just place your order, tell us what the problem is, and leave the headaches to Pratt & Whitney.



10 Everything about this reamer has been checked several times, but now that it's finished, P&W old-timer John Ramsay gives it final checks.

11 Mounted on centers, our reamer is checked again for run-out. Ramsay again, Barrett kibitzing.

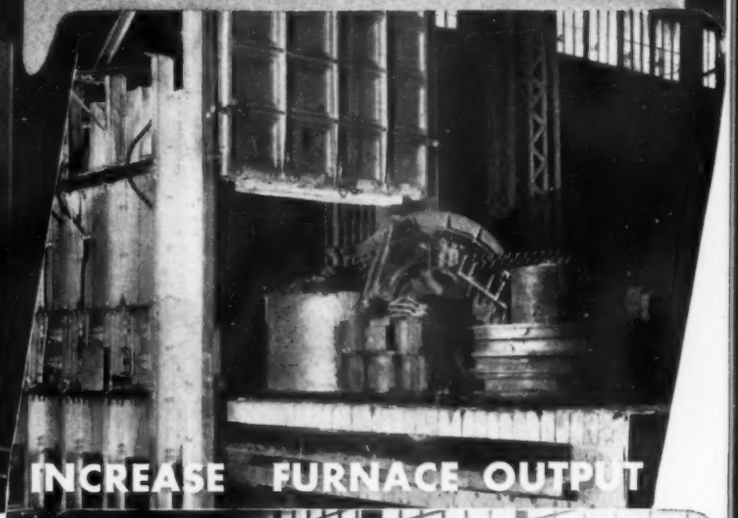
12 This is it, ready to join other P&W small tools working to build a coffin for Hitler. Exceptional only because its birth has been so thoroughly documented, this reamer is just one of thousands of P&W top quality small tools running our production gamut at the same time. As you read this, it's at work for Victory.

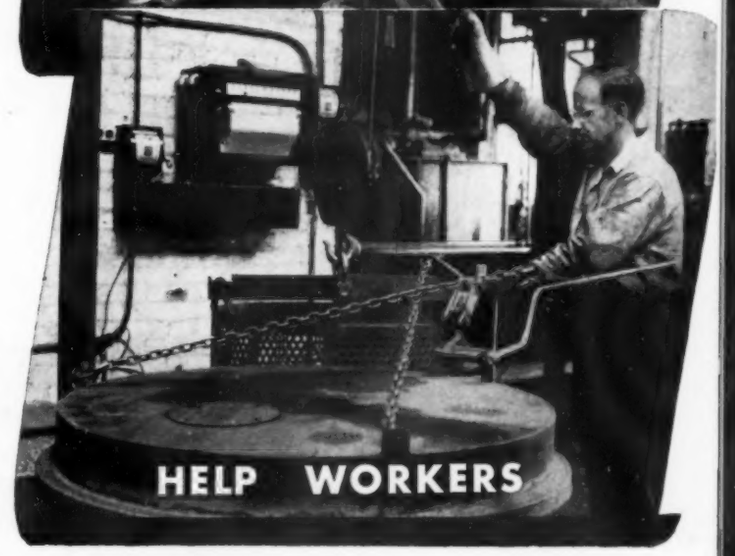
PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT

BROWN CONTROLLERS *for* TREATMENT OF METALS





Quality and *Quantity* are most essential in producing tools of war.

If your plant is confronted with new and intricate temperature control problems in the treatment of metals for Planes, Guns, Tanks, Ships, etc.—you can rely on Brown Controllers to standardize quality and speed-up production.

Throughout the metal working industries, Brown Indicating, Recording and Control Potentiometers are helping skilled and unskilled workers to produce better quality—conserve war materiel—increase furnace output—eliminate rejects and re-treatments.

Whether you heat-treat steel—make die castings — bake enamel or do galvanizing — your war materiel, furnaces, time and money are staked on accurate temperature control.

That is why leading companies are turning to Brown and Minneapolis - Honeywell Control Systems for positive control of temperature processes. They are applicable for any type furnace—oil, gas or electric. You'll find them everywhere, on all makes of furnaces used for every kind of work where precision temperature measurement and control mean low cost furnace operation.

BROWN POTENTIOMETER CONTROLLERS

THE BROWN INSTRUMENT COMPANY, 4501 WAYNE AVENUE, PHILADELPHIA, PENNSYLVANIA

DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO.

MINNEAPOLIS, MINNESOTA, AND 119 PETER STREET, TORONTO, CANADA

Wadsworth Road, Perivale, Middlesex, England — Nybrokajen 7, Stockholm, Sweden

HOW MUCH SCRAP IRON

WAR PRODUCTION MUST HAVE 140,000 TONS OF SCRAP A DAY!

CAN *YOU* MOBILIZE EVERY WEEK?

THE plain fact is—we can't win this war without plenty of steel. But if we are to have plenty, all factories, mills, shops, mines and other units of American industry must organize at once to turn in every available pound of scrap metal—and keep on turning it in regularly.

At least six million tons more scrap must be collected than last year!

Where is this "extra" scrap?

Part of it may be on your premises! It is certain that a vast mountain of precious iron and steel lies idle in unsuspected hiding places throughout the country. The usual methods of collection will not release enough to meet present demands. It will take special diligence on the part of every executive in industry to put the 1942 Scrap Drive over the top. To get started with your part in this job, check these three kinds of scrap, and see if you are turning in all three:

"BREAD-AND-BUTTER" SCRAP— The kind most plants sell regularly — filings, shavings, stampings — metal scrap created in the process of manufacture or construction.

DORMANT SCRAP — Unused or abandoned equipment, broken or worn-out machine parts, old boilers, moulds, dies, pipe, valves, electrical equipment, engines, trucks, etc.—the "junk" that accumulates but often misses routine scrap collection.

"RAINY-DAY" SCRAP—The hardest of all to part with. Includes obsolete machinery, unused metal buildings, stacks, outdated tools, fixtures, patterns, stocks, etc.—idle now because they're being saved for possible use in some indefinite future emergency. The emergency is here! This metal should be scrapped, unless it can be reconditioned and put to work now.

★ *Your scrap is worth its weight in Victory!* ★

By organizing a thoroughgoing salvage program now, you'll not only serve your country, but you'll also bring additional income to your business and pave the way for more economical post-war operation through the elimination of waste.

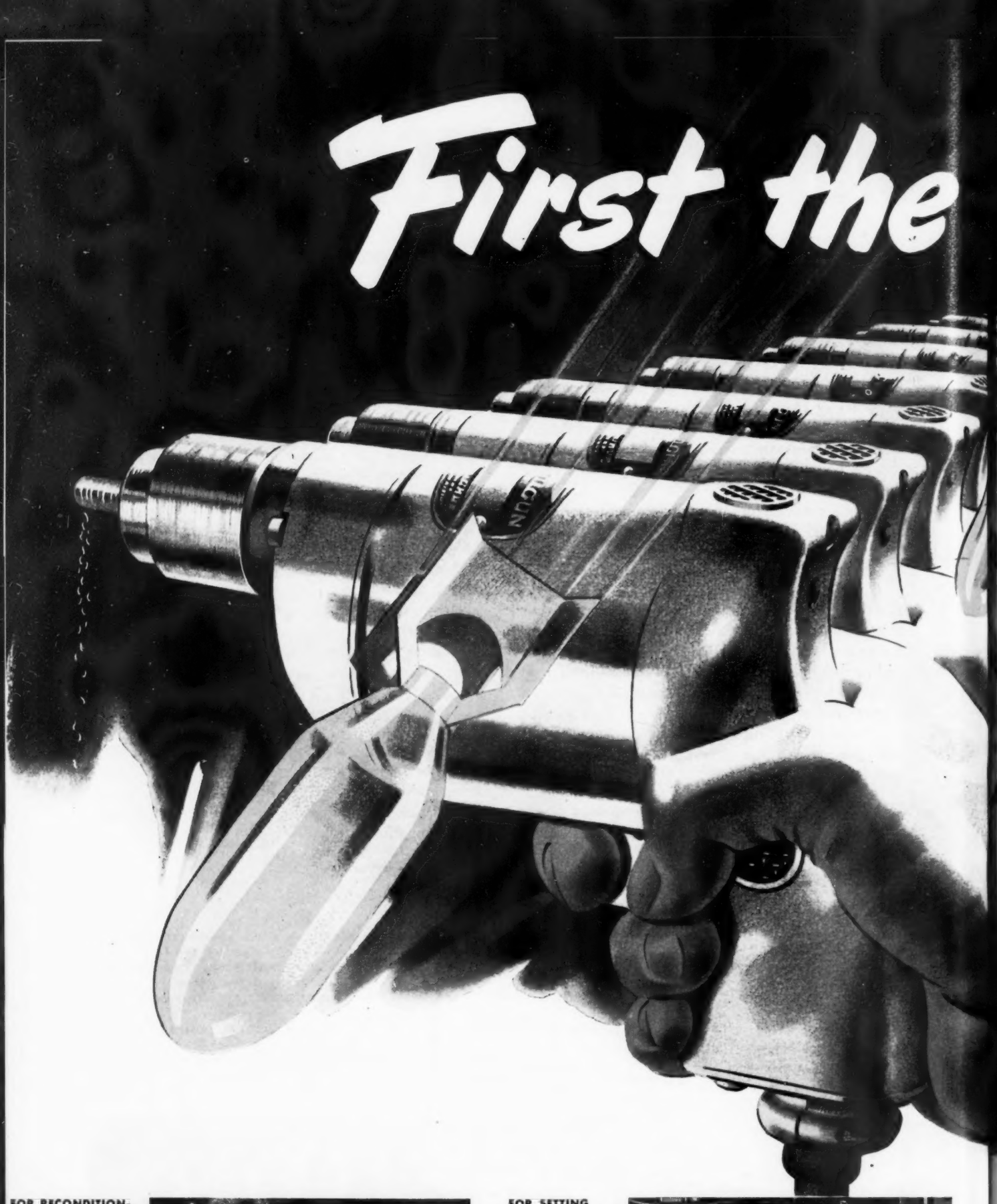
SUGGESTION: ***Organize your own scrap drive!***

1. Put some one individual in charge of salvage in all departments of your business, and *give him the authority to act.*
2. Organize a forceful program, with the help of your local Industrial Salvage Committee.
3. Promote the drive to all your employees. Dramatize it with posters and incentive systems. Make every man and woman "scrap conscious."
4. Emphasize *speed* and *continuous* effort. The quicker scrap gets to steel mills, the faster tanks and ships get into action. And it must *keep on coming*, as long as the war lasts.
5. For help or information, contact your local W.P.B. office, or write to the Bureau of Industrial Conservation, War Production Board, Washington, D.C.

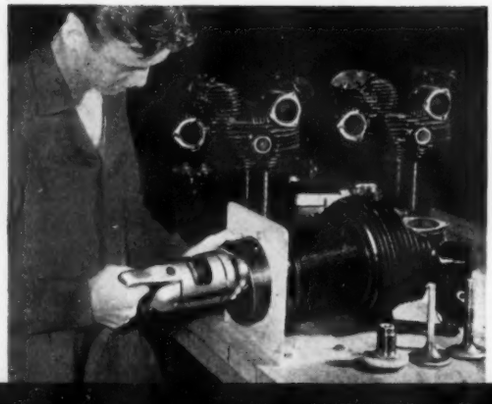
AMERICAN STEEL & WIRE COMPANY
Cleveland, Chicago and New York
CARNEGIE-ILLINOIS STEEL CORPORATION
Pittsburgh and Chicago
COLUMBIA STEEL COMPANY
San Francisco
NATIONAL TUBE COMPANY
Pittsburgh
TENNESSEE COAL, IRON & RAILROAD COMPANY
Birmingham

USS
UNITED STATES STEEL

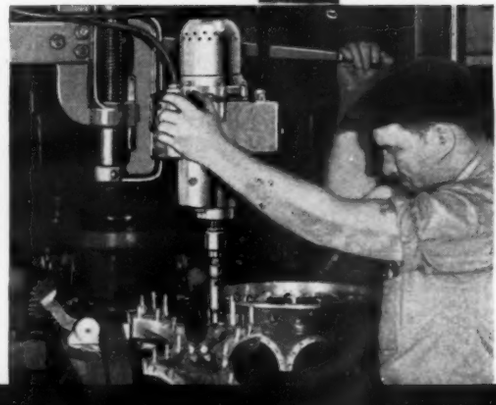
First the



FOR RECONDITIONING VALVES
and valve seats, at airdromes and in combat zones, Black & Decker Electric Valve Refacers and Valve Seat Grinders do factory-accurate work at war-emergency speed.



FOR SETTING STUDS
in aircraft engines (illustrated), or driving anything from tiny screws to large nuts and bolts, Black & Decker Power Drivers speed many assembly operations.



e Hum of Drills — Then the SHRIEK of Bombs!

BLACK & DECKER Electric Tools help produce a War Plane every 9 minutes!

THE Black & Decker Holgun is the most widely used electric tool in the aircraft industry. Light, compact, with "Pistol Grip and Trigger Switch," the Holgun 1/4" Drill is designed for work in tight places, won't heat up under extreme service. Holgun comes in torques and spindle speeds for production drilling in all types of aircraft materials—in parts, sub-assemblies and assemblies—in armaments, instruments and equipment.

The Holgun is just one of many Black & Decker Portable Electric Tools used to speed aircraft production, maintenance and repairs. Drills and Tappers, Screw Drivers and Nut Runners, Grinders and Sanders, Saws and Sheet Metal Shears—all are playing their part in speeding American airpower into action. One plane every 9 minutes! That's America's 1942 *average*. Production is actually faster than that *right now!*

Expert Help—*QUICKLY!*

For advice on any tooling problem, and as a dependable, convenient source of supply, 'phone your nearby Black & Decker Distributor. Or write to: The Black & Decker Mfg. Co., 716 Penna. Ave., Towson, Md.

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

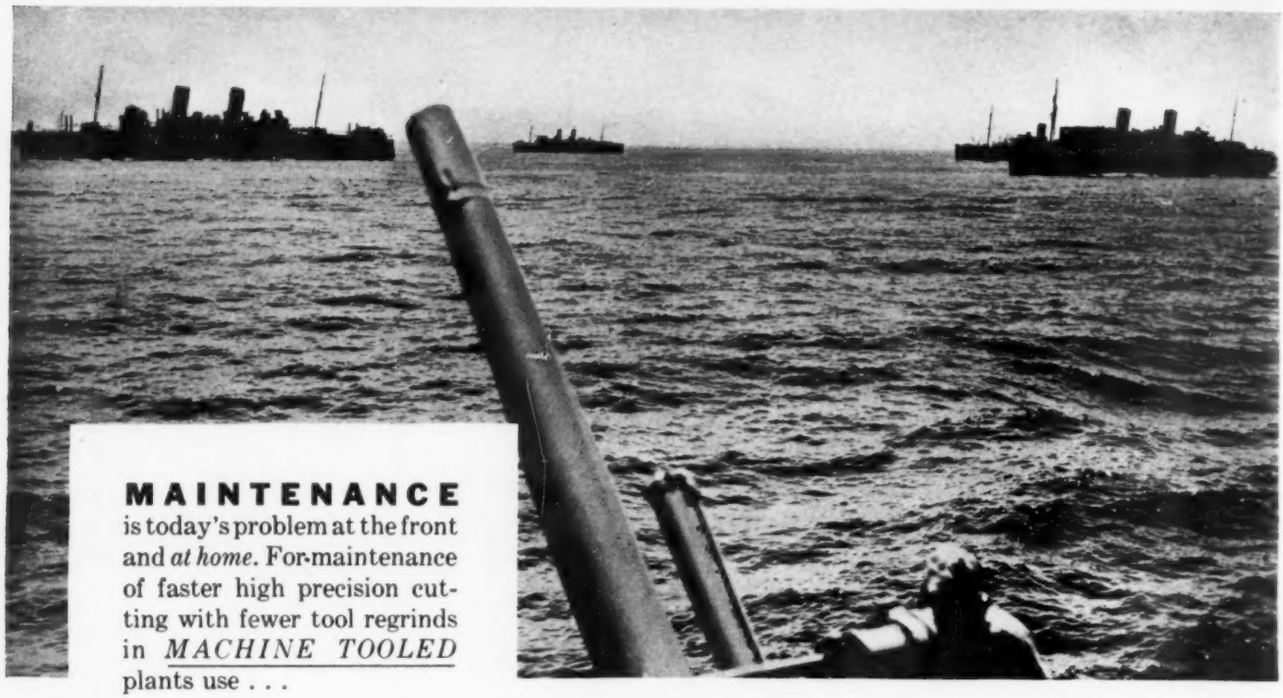
PORTABLE ELECTRIC TOOLS

FOR SHEET METAL CUTTING

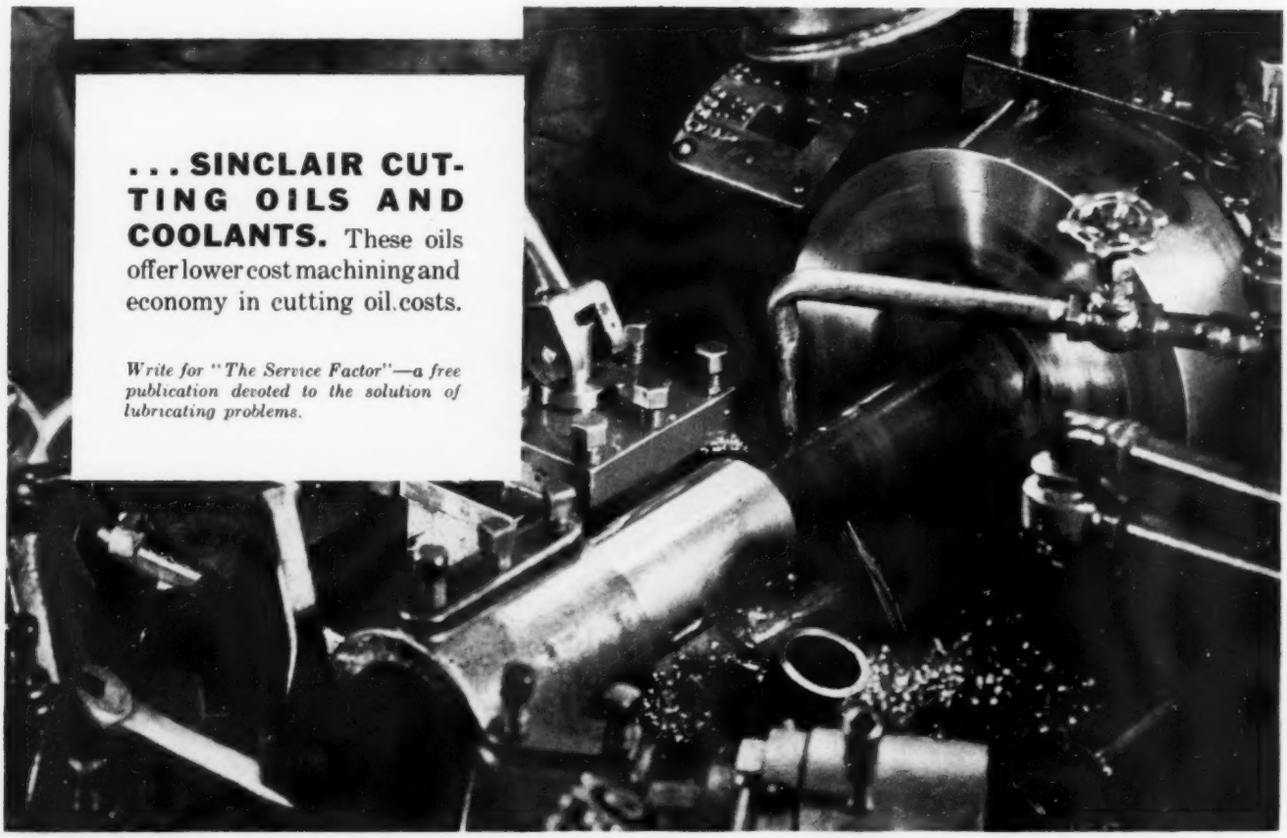
Black & Decker Lectro-Shears handle intricate pattern work or straight line cutting at top speed. Lectro-Shears are available in 16-gauge and 18-gauge models.

FOR PRODUCTION DRILLING

the Holgun 1/4" Drill comes in a variety of spindle speeds, from high torque at 500 R.P.M. to high speed at 5,000 R.P.M. Other drill models range from 3/16" to 1 1/2".



MAINTENANCE is today's problem at the front and *at home*. For maintenance of faster high precision cutting with fewer tool regrinds in *MACHINE TOOLED* plants use . . .



. . . SINCLAIR CUTTING OILS AND COOLANTS. These oils offer lower cost machining and economy in cutting oil costs.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.

SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

SINCLAIR REFINING COMPANY (Inc.)

2540 West Cermak Road, Chicago • 10 West 51st Street, New York City • Rialto Bldg., Kansas City • 573 West Peachtree Street, Atlanta • Fair Building, Ft. Worth

KEEPING WAR PRODUCTION ROLLING

Leadership
M-R-C
Strom
SRB
GURNEY
BALL BEARINGS

M-R-C BALL BEARINGS

MARLIN-ROCKWELL CORPORATION

Executive Offices: **JAMESTOWN. N. Y.**

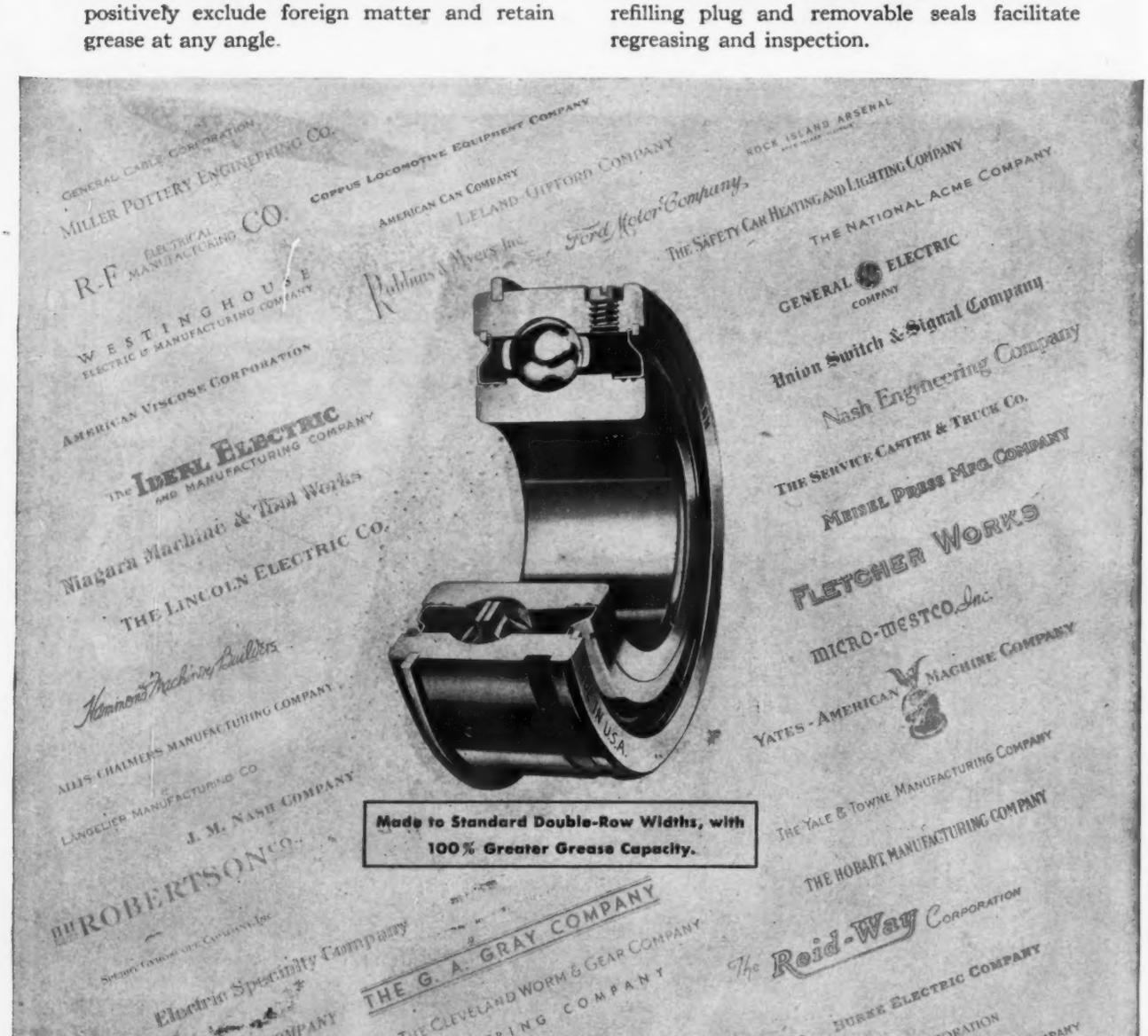
"CARTRIDGE" BALL . . . BEARINGS

SIMPLIFY your design by eliminating supplementary outside closure parts and protective seals.

PROTECT against the dirt hazard by the use of highly effective, wearless metal seals that positively exclude foreign matter and retain grease at any angle.

SAVE by cutting out many costly machining operations and extra parts, and by speeding up production.

INSURE longer life and lower maintenance costs by providing 100% greater grease capacity; refilling plug and removable seals facilitate regreasing and inspection.



Made to Standard Double-Row Widths, with 100% Greater Grease Capacity.

The manufacturers whose names appear above are among the many using "CARTRIDGE" ball bearings to advantage in their equipment.

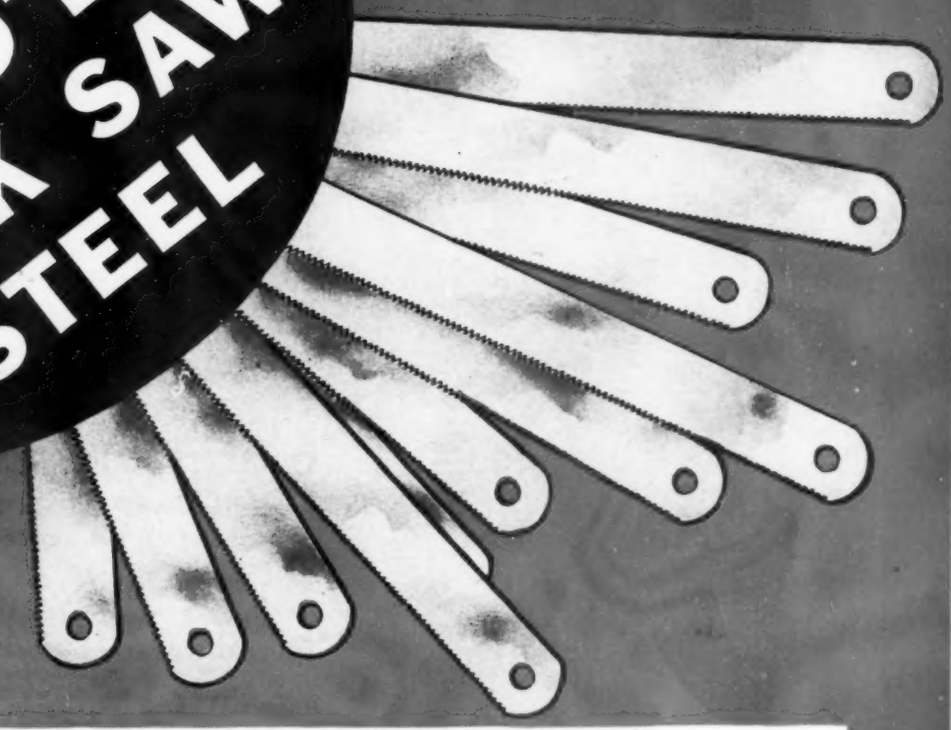
– Write for the Catalog. Let our engineers work with you.

NORMA-HOFFMANN BEARINGS CORPN., STAMFORD, CONN. U.S.A.

A New Steel *Perfected*—

Just when You Need it Most!

INGERSOLL D-B-L* HACK SAW STEEL



* Produced under exclusive license arrangement with Allegheny-Ludlum Steel Corporation

Other Special INGERSOLL Sheet Steels include:

- Alloy Steels
- Armor Plate
- Clutch Plate Steels
- Tillage Steels
- Soft Center Steels
- Shovel Steels
- Knife Steels
- TEM-CROSS Steel
- IngAclad (Stainless-Clad Steel)
- Stainless Steels and Saw Steels, including "18-4-1" and Molybdenum and D-B-L Hack Saw Steels.

Faced with the biggest job it has ever known, American Industry welcomes the timely development of Ingersoll D-B-L.

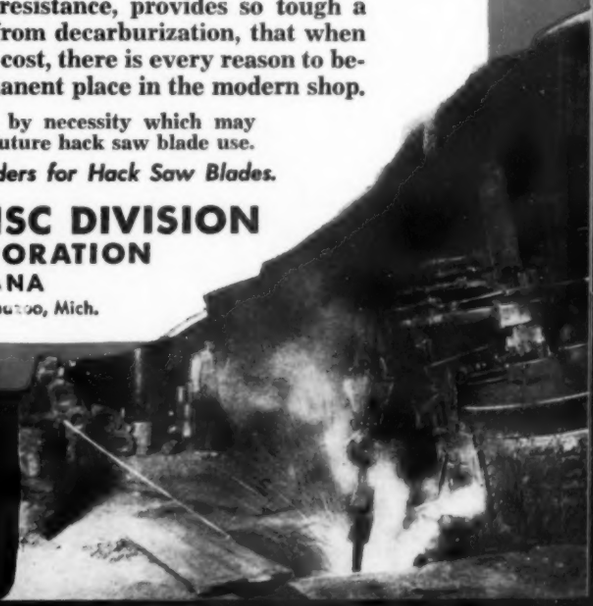
With 18-4-1 restricted by the shortage of vital alloys, the problem of supplying hack saw blades that would meet every shop need became a serious one.

Ingersoll D-B-L is so high in impact resistance, provides so tough a cutting edge, and is relatively so free from decarburization, that when these advantages are added to its lower cost, there is every reason to believe Ingersoll D-B-L has found a permanent place in the modern shop.

Here is one substitute developed by necessity which may well become the prime metal for future hack saw blade use.

Specify Ingersoll D-B-L Steel on orders for Hack Saw Blades.

INGERSOLL STEEL & DISC DIVISION
BORG-WARNER CORPORATION
NEW CASTLE, INDIANA
Plants: New Castle, Ind.; Chicago, Ill.; Kalamazoo, Mich.



INGERSOLL

SPECIAL STEELS for SPECIAL USES

7 WAYS DE LAVAL . . . HELPS IN THE

"Hermetic" Coolant Clarifiers keep grinding coolant free of the tiniest metal particles and abrasive. Coolant is discharged under pressure, which eliminates foam. Constant high clarifying efficiency is assured on both aqueous and oil coolants.

1 *GRIND TO CLOSER LIMITS*

De Laval Coolant Clarifiers keep coolant free from harmful abrasives and metallic sediment, making it possible to grind to closer limits. The clarified coolant may be used continuously without impairing its efficiency.

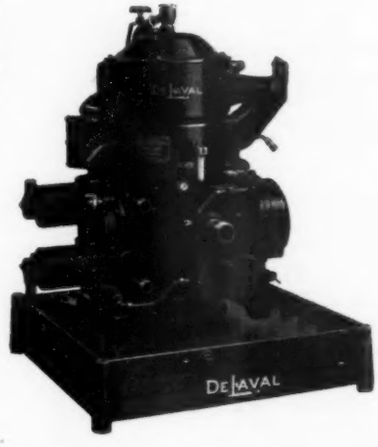
2 *LONGER TOOL LIFE*

Machine tools can be protected against undue wear by purifying cutting oil with a De Laval Centrifugal Oil Purifier to remove the chips and fine particles of metal that break down the cutting edges of tools. Efficient extraction of cutting oil from chips in De Laval Extractors salvages both oil and chips.

3 *BETTER FINISHES WITH PURIFIED OIL*

Improved finishes are produced when grinding coolant and cutting oil are purified by centrifugal force.

The De Laval "Uni-Matic" Oil Purifier is a self-contained purification plant in which are included built-in pumps, heaters, gauges, thermometer, sight glasses and all other equipment necessary to purify oil.



DE LAVAL ..... COOLANT

CENTRIFUGAL EQUIPMENT

BATTLE FOR MORE AND BETTER PRODUCTION

4 *MEN ARE SAFEGUARDED*

De Laval purification of cutting oil, following sterilization by heating, reduces the infection hazard to a minimum. With factories working on continuous shifts, the advantage of having oil kept clean and sterilized at all times is especially valuable.

5 *FINISHED PARTS ARE PROTECTED*

Whether the problem involves coating a part with slushing compound as a protection against rust, or washing a part with a solvent to remove metallic particles and grit, purification of the compound or oil by means of a De Laval Purifier will enable them to perform their functions most efficiently.

6 *CLEAN LUBRICATING OIL SAVES MACHINES*

The difficulty of obtaining new automatic machines puts a premium on keeping those you have in good condition. By centrifugally purifying the oil used in central lubricating systems so that it is kept free of metallic particles, grit and water, wear on running parts can be reduced and machine service life extended.

7 *OIL CAN BE USED CONTINUOUSLY*

Factory oils purified by De Laval equipment can be used over and over again, resulting in important economies. The quantity of make-up required will be much less when the oil is kept clean by removing dirt and water.

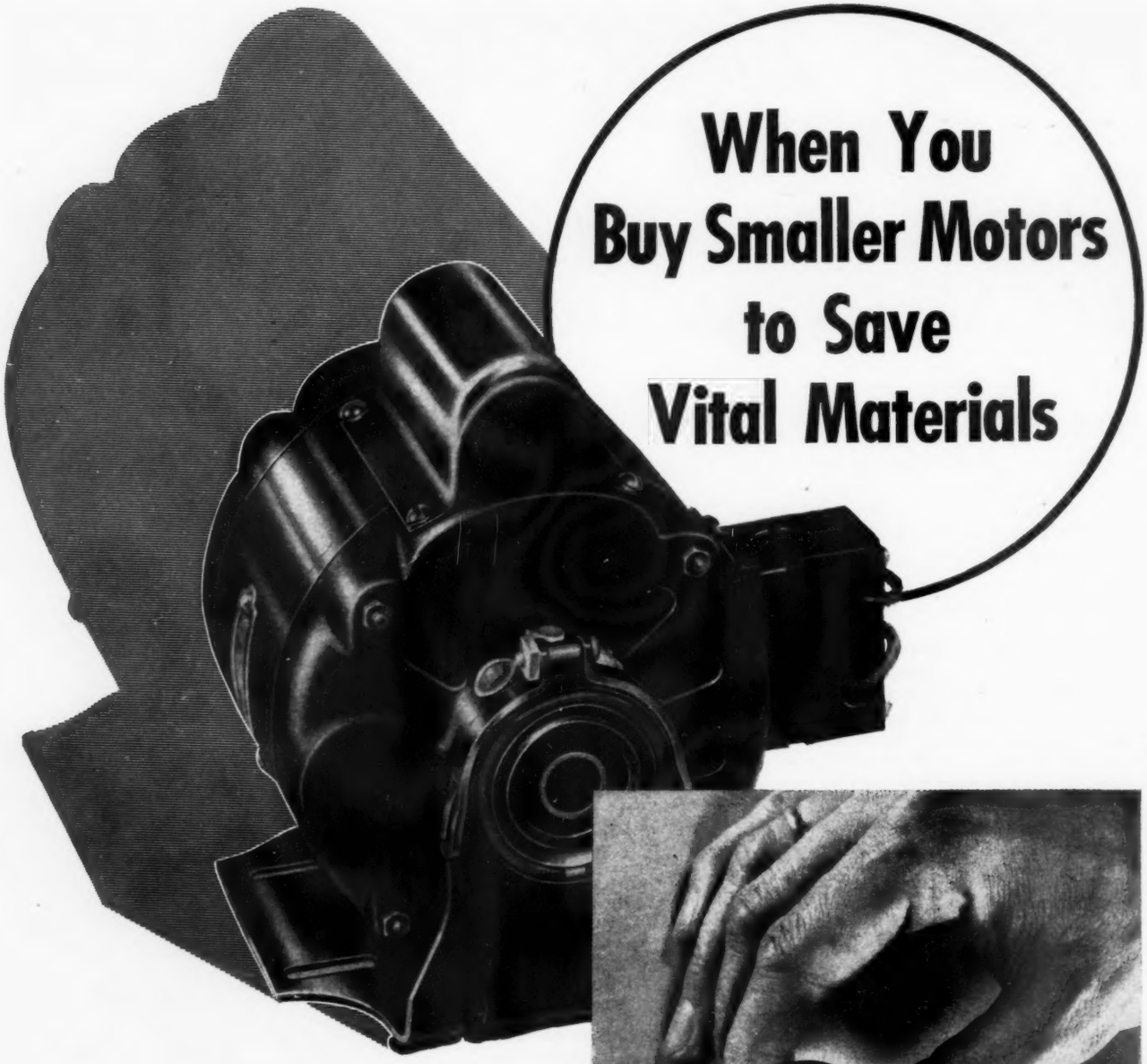
▼ ▼ ▼

De Laval engineers will be pleased to give you additional information on any phase of factory oil purification. Whether the job calls for a large central purification system or small portable equipment for individual machines, De Laval invites you to take advantage of its long and varied experience.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 427 Randolph St., Chicago
DE LAVAL PACIFIC CO., 61 Beale St., SAN FRANCISCO
THE DE LAVAL COMPANY, Limited
Montreal . . Peterborough . . Winnipeg . . Vancouver

De Laval Direct Drive Centrifugals are built in a wide range of styles and sizes for various purposes and in capacities up to several thousand gallons per hour. Also available as portable units.

CLARIFIERS ... OIL PURIFIERS



When You Buy Smaller Motors to Save Vital Materials

Be Sure They Have Built-in

Klixon Protectors

Industry, these days, is buying motors to meet required capacities more closely. The safety margin is being sacrificed to save copper and other vital materials. And that is just one more reason for you to insist on motors with built-in Klixon Protectors. Motors with built-in Klixon Protectors can be run at peak capacity with safety. A Klixon Protector sees to it *automatically* that a motor can't burnout either from overloading or overheating.

Don't forget, a burned out motor means a loss of copper and other vital materials. It means man hours for repairs. It means delays plus added expense for replacements. Stop this waste by insisting on motors with built-in Klixon Protectors. You can have them with A.C. motors all sizes or D.C. motors up through 30 volts. Ask your supplier.

KLIXON

TRADE MARK REG. U.S. PAT. OFF.

Spencer Thermostat Co., 1510 Forest St., Attleboro, Mass.

SERVING AMERICA'S WAR INDUSTRIES

Southwark

for

HYDRAULIC PRESSES
and
SPECIAL MACHINERY

Baldwin Southwark

DIVISION OF
THE BALDWIN LOCOMOTIVE WORKS
PHILADELPHIA

BLW
THE BALDWIN GROUP

BUZZER INDUSTRIAL GAS FURNACES

NO BLOWER OR POWER NECESSARY

ASSURE MAXIMUM ECONOMY, EFFICIENCY and SERVICE

Buzzer Industrial Gas Equipment represents many years of specialized experience in the development and manufacture of atmospheric gas burning equipment. An outstanding feature of this equipment is its operation on city gas without the need of blower, power or any auxiliary equipment whatever. Buzzer Furnaces are ready for operation immediately by merely connecting to gas supply.

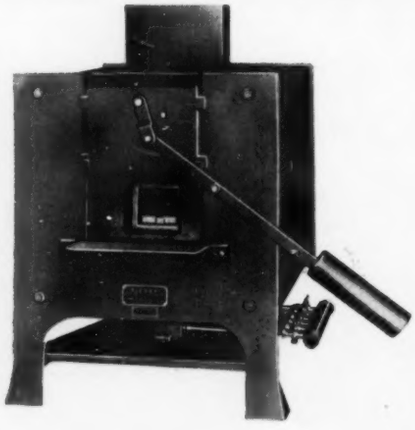
BUZZER POT HARDENING FURNACES

1650 degrees in 75 minutes

These tangentially fired, atmospheric furnaces will heat from cold to 1650°, using a popular brand salt, in an average time of 1 hr. 15 min. They require no auxiliary equipment such as blowers, boosters, etc.

Insulated with a high grade refractory, BUZZER pot hardening furnaces can be depended on for longer pot life, operating convenience and economy, high efficiency and utmost safety to operator. They are adaptable to melting zinc, aluminum and lead and are built in several standard sizes with automatic controls. Complete details available promptly on request.

Rectangular Melting Furnaces in Various Sizes Built to Requirements



BUZZER HIGH SPEED MUFFLE FURNACES *2400 degrees in 90 minutes*

High temperatures are quickly attained with Buzzer heat treating furnaces without blower or power and by just connecting to gas supply. Protective atmospheres, low fuel consumption and flexibility of control are other outstanding features which make Buzzer Fuel Muffle Furnaces ideal for heat treating high speed and alloy steels. Temperature up to 2400–F are reached in these furnaces in 1½ hours, using city gas without auxiliary equipment. Installation expense and the cost of gas are exceedingly low. Long life is assured by rugged construction and effective, efficient, high grade insulating fire brick.

These Buzzer units are made in several bench sizes. Also large floor types.

Write for complete details.

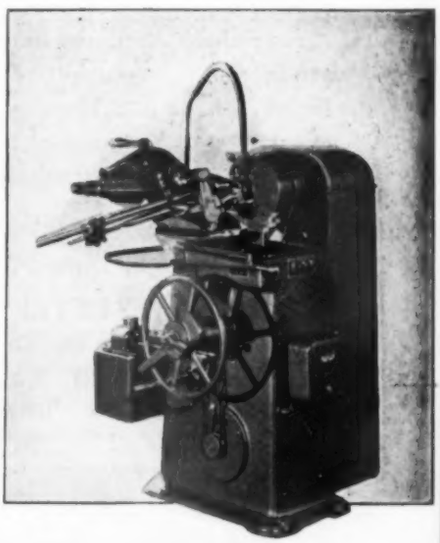
BUZZER GAS EQUIPMENT Gas Furnaces, Burners, Torches; Oven Furnaces; Muffle Furnaces; Atmospheric Pot Furnaces; Melting Furnaces. Send for complete catalog.

CHARLES A. HONES INC., 121 So. Grand Ave., Baldwin, N. Y.

Grind 'em Right -and FAST

Drilling operations today must be kept on a continuous production basis. Worn drills, therefore, must be ground *right*—and *quickly!* With drills ground on Sellers Drill Grinders you eliminate under- and oversize holes, because the drills are ground accurately . . . you increase production, because drills remain sharp longer . . . you lengthen drill life, because less material is ground away . . . you cut set-up time on multiple spindle machines since drills are ground to equal lengths and sets of drills can be replaced without individual spindle adjustment . . . and production is speeded up, because *accurate* drilling requires no bushing or reaming.

WILLIAM SELLERS & CO.
INCORPORATED
1610 HAMILTON STREET
PHILADELPHIA, PA.



FOUNDED SELLERS 1848

Sellers

HAYNES STELLITE ALLOY prolongs the life of hot-work dies . . .

and in addition saves refitting time

Haynes Stellite hard-facing alloy increases the life of hot-work dies because it resists abrasive wear at high temperatures. In addition, maintenance costs are greatly reduced—not only because dies have to be changed less frequently, but also because you can refit a hard-faced die in much less time than is required for refitting a plain steel die.

Shown at the right are 8 dies—used in the plant of a large motor manufacturer—which were hard-faced with Haynes Stellite No. 6 alloy. These hard-faced dies have outlasted steel dies from 3 to 6 times, and they are refitted in approximately half the time required for the ordinary dies.

Hard-Facing Is Used Profitably On Many Other Parts

Haynes Stellite alloy is being used *profitably* on wearing parts in practically every industry. To decrease maintenance work . . . to reduce shutdown time . . . to maintain production . . . take full advantage of hard-facing. There is a Haynes Stellite rod for every type of application. For a descriptive price list of these materials, write or phone any district office.

Headquarters for Hard-Facing Materials

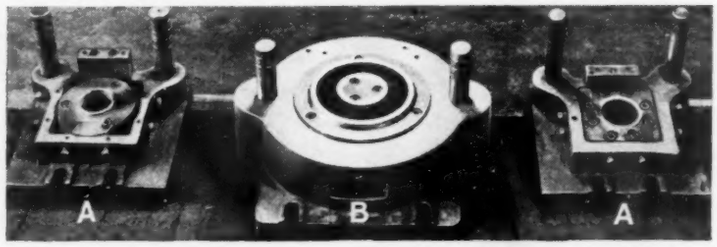
HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

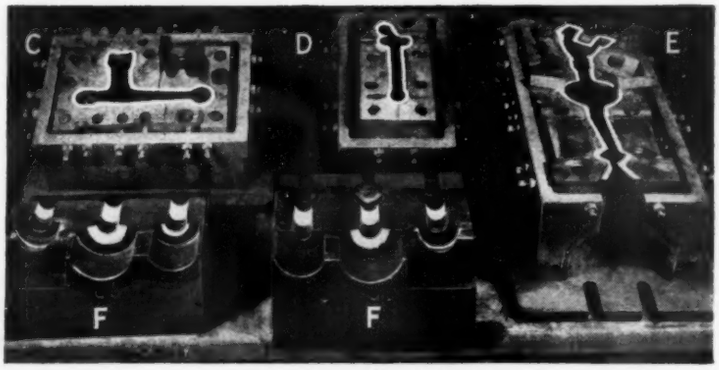
New York, N. Y. UCC **Kokomo, Indiana**

Chicago — Cleveland — Detroit — Houston
Los Angeles — San Francisco — Tulsa

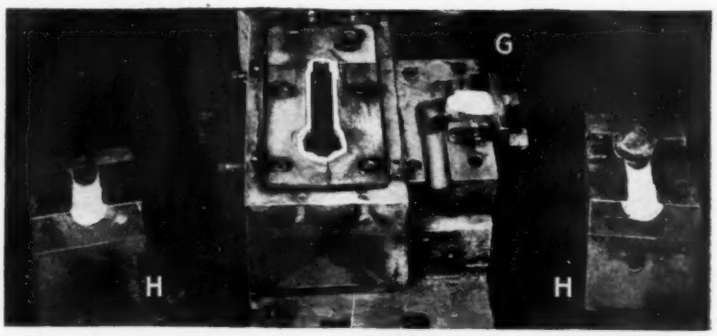
HAYNES STELLITE TRADE MARK



	No. of Pieces Between Refittings	*Hours Required to Refit Die*
A—Hot-Trimming Die for Rear Axle Differential Gear	Steel—4,000 Hard-Faced—20,000	Steel—16 Hard-Faced—6
B—Hot-Trimming and Piercing Die for Ring Gear	Steel—2,500 Hard-Faced—15,000	Steel—20 Hard-Faced—12



	No. of Pieces Between Refittings	*Hours Required to Refit Die*
C—Hot-Trimming Die for Wheel Support	Steel—2,500 Hard-Faced—7,500	Steel—16 Hard-Faced—8
D—Hot-Trimming Die for Steering Crank	Steel—1,750 Hard-Faced—7,500	Steel—16 Hard-Faced—8
E—Hot-Trimming Die for Front Wheel Support Arm	Steel—2,500 Hard-Faced—7,500	Steel—40 Hard-Faced—20
F—Upsetting Die for Pinion Gear	Steel—5,000 Hard-Faced—25,000	Steel—120 Hard-Faced—70



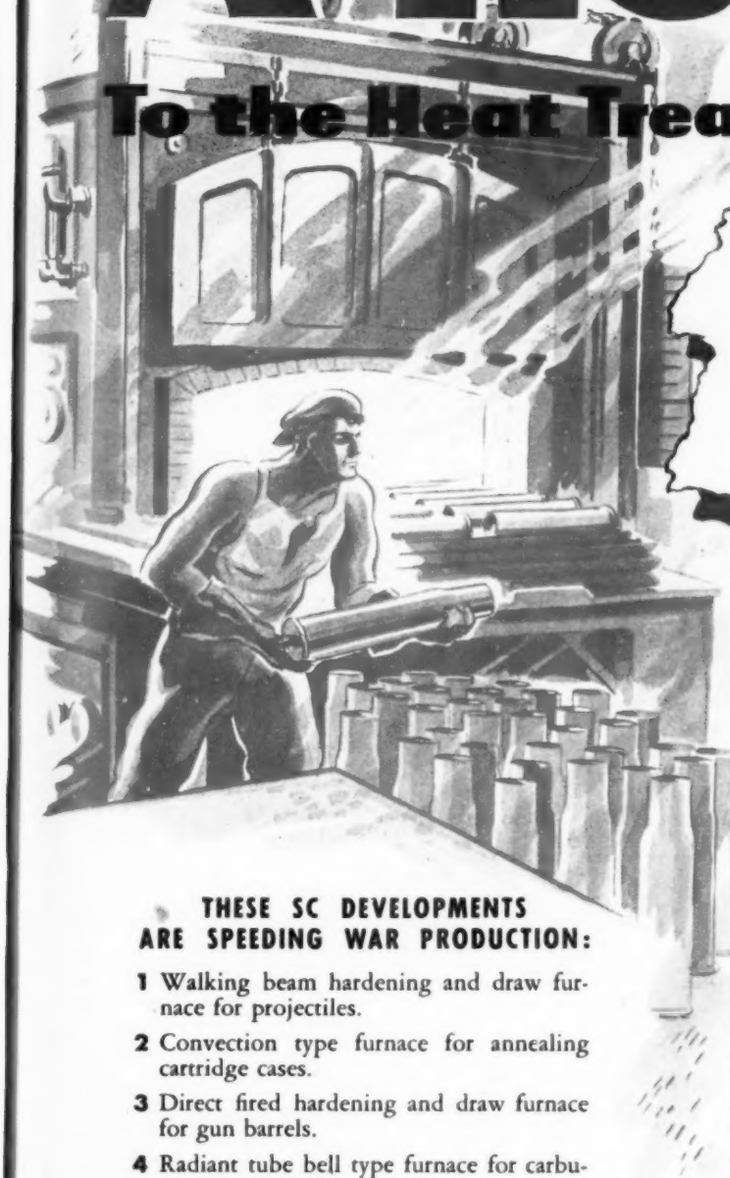
	No. of Pieces Between Refittings	*Hours Required to Refit Die*
G—Hot-Trimming Die for Steering Cross Shaft	Steel—3,500 Hard-Faced—15,000	Steel—28 Hard-Faced—10
H—Upsetting Die for Pinion Gear	Steel—5,000 Hard-Faced—25,000	Steel—120 Hard-Faced—70

Red-hard, wear-resisting alloy of cobalt, chromium, and tungsten.

"Haynes Stellite" is a registered trade-mark of Haynes Stellite Company.

A Report

To the Heat Treaters of America



TO WIN A BATTLE OR A WAR, EQUIPMENT ALONE IS NOT ENOUGH. THE FINEST TOOLS IN THE WORLD ARE WASTED UNTIL THEY ARE PROPERLY PUT TO WORK AND THEN USED FULLY AND EFFICIENTLY

★ Today, SC Heat Treat Engineers literally live with the metal working industry.

Veterans of peace-time heat treating, these men have made themselves expert in war practice, too. Their assignment is to see to it that SC Furnaces are on the job for Victory.

SC Engineering Service goes much farther than that. Long at the forefront in applying heating in industrial problems, Surface Combustion has become a responsible clearing house on the heat treatment of armament. Its great fund of information on war materials manufacture grows steadily larger. Continuing study and research perfect treatment of new metals, advance new treatments for old ones. SC Engineers are called in to help set up new methods. And when new needs arise, SC usually has or can readily furnish the type of equipment it takes.

"Right . . . and on time." That's the principle which has governed production at Surface Combustion for more than a generation. And it applies equally well to SC Engineering Service.

THESE SC DEVELOPMENTS ARE SPEEDING WAR PRODUCTION:

1. Walking beam hardening and draw furnace for projectiles.
2. Convection type furnace for annealing cartridge cases.
3. Direct fired hardening and draw furnace for gun barrels.
4. Radiant tube bell type furnace for carburizing tank parts.
5. Convection furnace for stress relieving gun turrets, etc.
6. Forging furnace for aeroplane propellers.
7. Convection car type furnace for stress relieving weldments.
8. Rotary furnace for projectile forging.
9. Roller hearth furnaces for annealing and normalizing tubing.
10. Char-Mo furnace for hardening projectiles.
11. Rotary furnace for projectile nosing.

. . . And in addition, a complete line of standard and special furnaces for all heat treat operations.

AT THE METAL SHOW we will welcome the opportunity of discussing your heat treating problems with you. Stop in and see us at **BOOTH No. D-118**

SURFACE COMBUSTION SC **TOLEDO, OHIO**

SAFCO

METAL WORKING LUBRICANTS

Add Wings to Production Schedules!

Greater speed — — — rigid precision control,
two vital needs — — — one tough job!

Under pressure and when meeting heartbreaking schedules, there's no time to lose on cutting or grinding operations—*call for a specialist!*—call for a SWAN-FINCH field man.

They are capable and trained men with years of highly specialized experience gained thru solving lubrication problems in many and varied kinds of metal working plants! They are ready and able to make recommendations and tests *right on the job.*

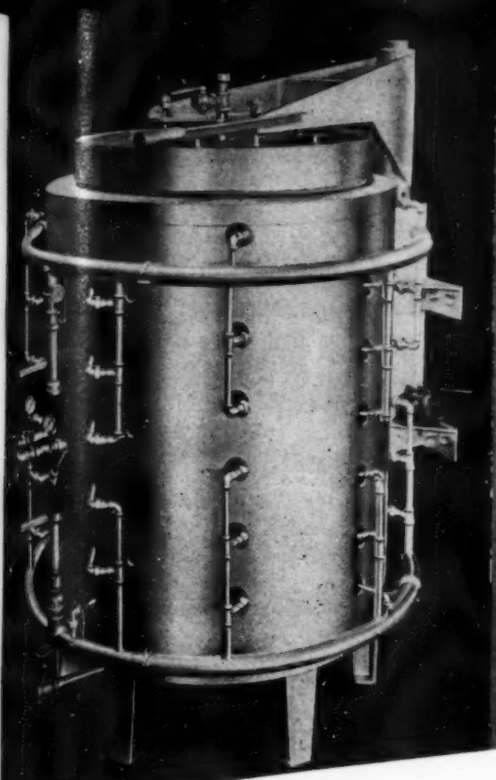
That's why, everyday more men engaged in vital war production, men who have a reputation for "getting things done" are specifying 'SAFCO' lubricants.

It will pay you real dividends to get better acquainted with the Swan-Finch field representative who covers your district. Capable and able, they are constantly devising *new* ways and means for stepping up production.

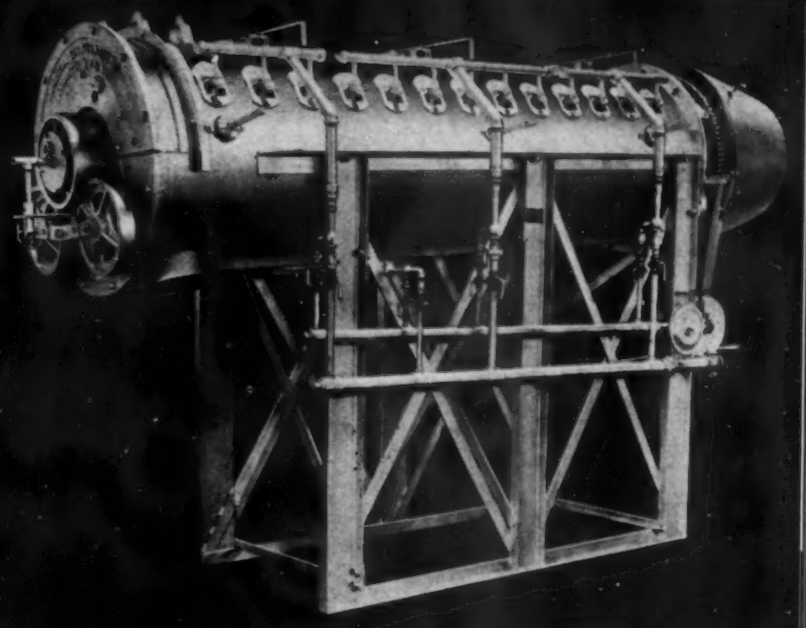
For instance meet Elliott Peabody. He is one of our highly trained and experienced fieldmen. ASK US TO HAVE HIM CALL—NO OBLIGATION.

SWAN-FINCH OIL CORPORATION

Offices		Plants	
New York City—Executive Offices	R.C.A. Building, West	Newark, N. J.	120 Lister Avenue
Chicago, Ill.	201 North Wells Street	Chicago, Ill.	5849 West 66th Street (Clearing, Ill.)
Detroit, Mich.	2596 Hart Avenue	Detroit, Mich.	2596 Hart Avenue



Improved Vertical Gas Carburizer (No. 19C). Duplication of results assured by an extreme uniformity of temperature throughout a totally enclosed retort and a uniform quality carburizing gas. No moving parts; rugged construction; low operating and maintenance costs.



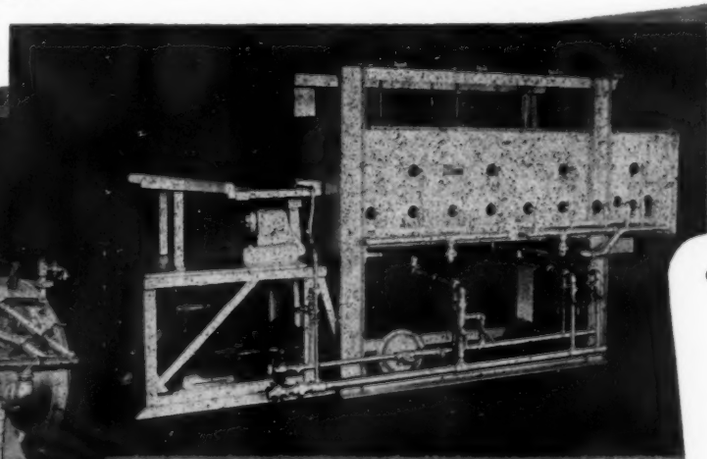
Rotary Retort for continuous clean hardening or carburizing (No. 139 Type). Only the work enters and leaves the heating chamber. Uniform temperature and high thermal efficiency are assured.

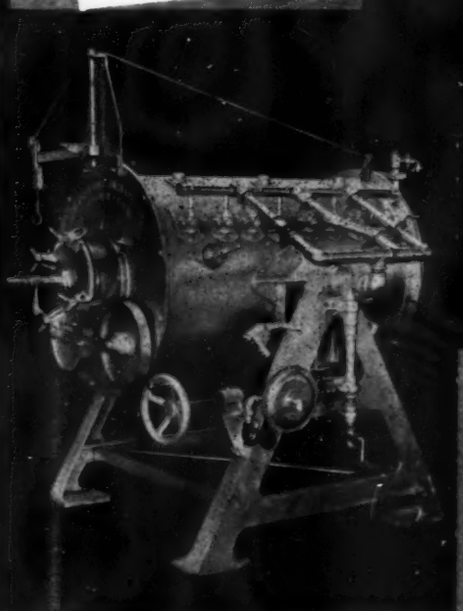
The "A.G.F." way is the modern way to heat treat

"A.G.F." experience covering more than half a century is ready to help you meet and solve any heat treating problems which are involved in war production.

"A.G.F." engineers are competent to advise you on your needs because they have pioneered many of the developments in industrial heating. The first air blast melter, the first rotary retort machine, the first to originate the gas carburizing process as well as the nitrogenizing (nitriding) process with equipment for its use—"American" engineers have always led the way.

"A.G.F." Heat Treating equipment is modern, operates on a minimum of fuel, produces uniformly satisfactory work, is easily controlled and is available for practically all heat treating purposes.





Continuous Clean Hardening Machine (No. 166 B-C Reciprocating Full Muffle). Developed to assure clean, hard work free from scale. A full muffle is provided through which work travels. Any desired temperature may be carried as well as any desired heating time.

Rotary Gas Carburizer (No. 2837). Rotation insures uniform results through mixing of work; tilting feature facilitates charging and discharging. Low in operating cost; handles a wide variety of work. Can be used also for clean hardening, annealing, normalizing, etc.

"A.G.F." OFFERS

FORGES
OVEN FURNACES
HIGH SPEED FURNACES
POT FURNACES
MELTERS
RECIPROCATING HEATING MACHINES
ROTARY HEATING MACHINES
CONVEYOR HEATING MACHINES
OPEN FLAME HEATING MACHINES
ROTARY TEMPERING MACHINES
SPECIAL HEATING MACHINES
GAS CARBURIZERS
TUBE FURNACES
CYLINDRICAL FURNACES

If your problem involves getting more and better work in shorter time—consult "A.G.F." Write, giving details, so that we can make a proper recommendation.

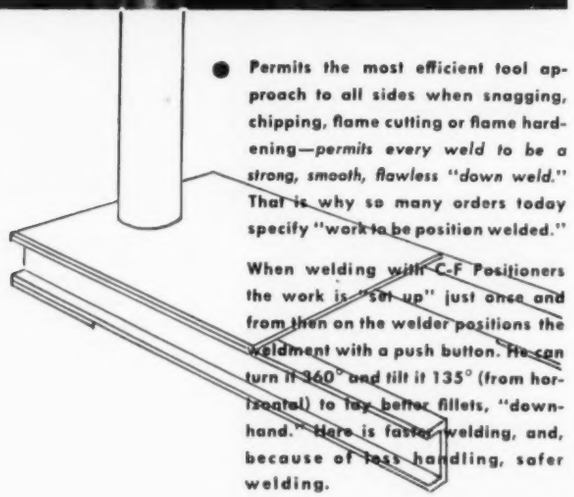
AMERICAN GAS FURNACE CO.

Elizabeth, New Jersey

AMERICAN GAS FURNACE CO. PIONEERS 1879

LIKE A GIANT HAND!

C-F POSITIONERS twist and turn heavy and cumbersome weldments as easily as you would turn a bit of steel in your hand.



- **Permits the most efficient tool approach to all sides when snagging, chipping, flame cutting or flame hardening—*permits every weld to be a strong, smooth, flawless "down weld."* That is why so many orders today specify "work to be position welded."**

When welding with C-F Positioners the work is "set up" just once and from then on the welder positions the weldment with a push button. He can turn it 360° and tilt it 135° (from horizontal) to lay better fillets, "down-hand." There is faster welding, and, because of less handling, safer welding.

C-F Positioners are made in capacities from 1,200 lbs. to 30,000 lbs., hand or power operated. Our booklet WP 22 is an interesting, fact-giving circular which you should have. We will gladly mail you a copy on request.

CULLEN-FRIESTEDT CO.,
1213 S. KILBOURN AVE. CHICAGO ILLINOIS

TALK ABOUT VERSATILITY!

ONE STOW Flexible Shaft Machine DOES

- **GRINDING**
- **SANDING**
- **WIRE-BRUSHING**
- **DRILLING**
- **BUFFING**
- **POLISHING**
- **FILING**

...and does it BETTER!

The great number of jobs that the Stow Flexible Shaft Machine can do has boosted its popularity by leaps and bounds. But it's not only versatility that you get with Stow. There's also rugged dependability in every Stow machine—that extra strength and heavy-duty power that keeps steadily at it day after day of hard, continuous production. And now, when every minute counts, you can save literally hours a day by taking these easily-moved machines **right to the job,** anywhere, and making quick, convenient applications for particular work.

NEW

STOW FLEXIBLE DRILL-SHAFT for Close-Quarter Operation

Attach this shaft to your electric drill and you've got an amazingly versatile, useful tool—one that can be used with one hand. Fitted with either a 90° or 45° Park angle head, it can reach into the most awkward corners—perform the closest possible drilling. Ideal for aircraft production and other "tight-spot" work.

Backed by 67 years' experience as the originators of the flexible shaft, today Stow offers the biggest selection of units and attachments on the market. Iron out many tough machining and finishing operations with the Stow Flexible Shaft Machine — it's a hundred tools in one! Send for our new catalog outlining the many valuable uses of Stow Machines in production lines, toolrooms and maintenance work . . . and if you've got a special problem let our engineers help solve it. Write us today!

STOW MANUFACTURING CO., Inc.
29 Shear St., Binghamton, N. Y.

Inventors of the Flexible Shaft

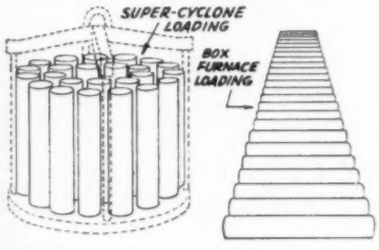
All the advantages of 100% forced convection heating in the hardening, normalizing and annealing range with the

LINDBERG SUPER-CYCLONE

The first furnace of its kind, employing 100% forced convection heating with a temperature range from 250° F. to 1750° F., the Lindberg developed Super-Cyclone is an ideal furnace for hardening, normalizing, annealing, tempering or nitriding. As a result of the 100% forced convection heating principle, production is increased, distortion minimized, material handling is reduced and less floor space is required to handle the same or increased production over conventional equipment.

INCREASED PRODUCTION

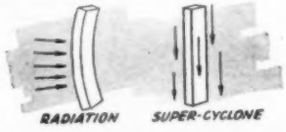
"Worm gear hardening *3 times greater* . . . bearing race hardening *7 times greater* . . . gray iron casting annealing *12 times greater.*" You can figure the Super-Cyclone's



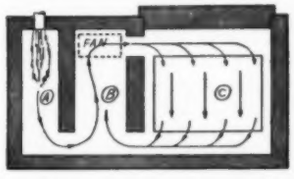
production possibilities in your own shop by spreading an average load of parts on the floor, one layer thick, as handled in a radiation type box furnace. Measure the area required. Take another load of those same parts and stack them up in a 36" circle, 4' high, making allowance for spacers or supports. Figure it will take a maximum of 3 hours to heat the load and 5 minutes to quench. Ordinarily you will find, by comparison with the laid out parts, that the Super-Cyclone will handle larger loads in the same or less time with a consequent increase in production, in some cases as high as 1200%.

KEEPS WORK STRAIGHTER

"Worm gear straightening is reduced from 85 out of 100 to 10 out of 100, thus saving 7½ hours straightening time per 100 gears." Rings that were previously heated and quenched individually on special jigs to hold them round, are now heated in a Super-Cyclone and quenched, 63 at a time without jigs, and held well within the acceptable range of .010".



The 100% forced convection heating principle of the Super-Cyclone heats the work rapidly and uniformly by driving heated air through the charge at high velocity. The heat source is confined to a chamber (A) away from the work (C) and separated by the fan chamber (B), thus preventing radiant heat of a source hotter than the



desired work temperature from striking the charge and causing distortion. As a result, valuable man hours are saved from the straightening press and made available for other work.

REDUCED HANDLING

The use of a fixture in the Super-Cyclone eliminates the individual handling of pieces throughout the heat treating process. The parts are loaded onto the fixture and remain there during the heating, quenching and tempering stages. And too, in reducing distortion to a minimum, the Super-Cyclone eliminates extra handling of work for straightening.

LESS FLOOR SPACE

Based on averages of what the Super-Cyclone has done in other plants, you can figure that it will require not more than ⅓rd the floor area demanded by conventional equipment to handle the same or increased production. In one plant alone, *a Super-Cyclone replaced 8 box type furnaces and turned out twice as much work!*

The Super-Cyclone's efficiency of operation, savings in man hours through the reduction of handling time and distortion, and the economy of floor space, makes it an ideal furnace for the large or small shop.

The Super-Cyclone is made in a wide range of sizes from 16" diameter by 20" deep to 72" diameter by 84" deep. Most are gas fired although a number are available electrically heated.

Write today for Bulletin 130 or ask to have the Super-Cyclone explained to you at the Lindberg Booth, National Metals Congress, Cleveland, October 12 through 16.

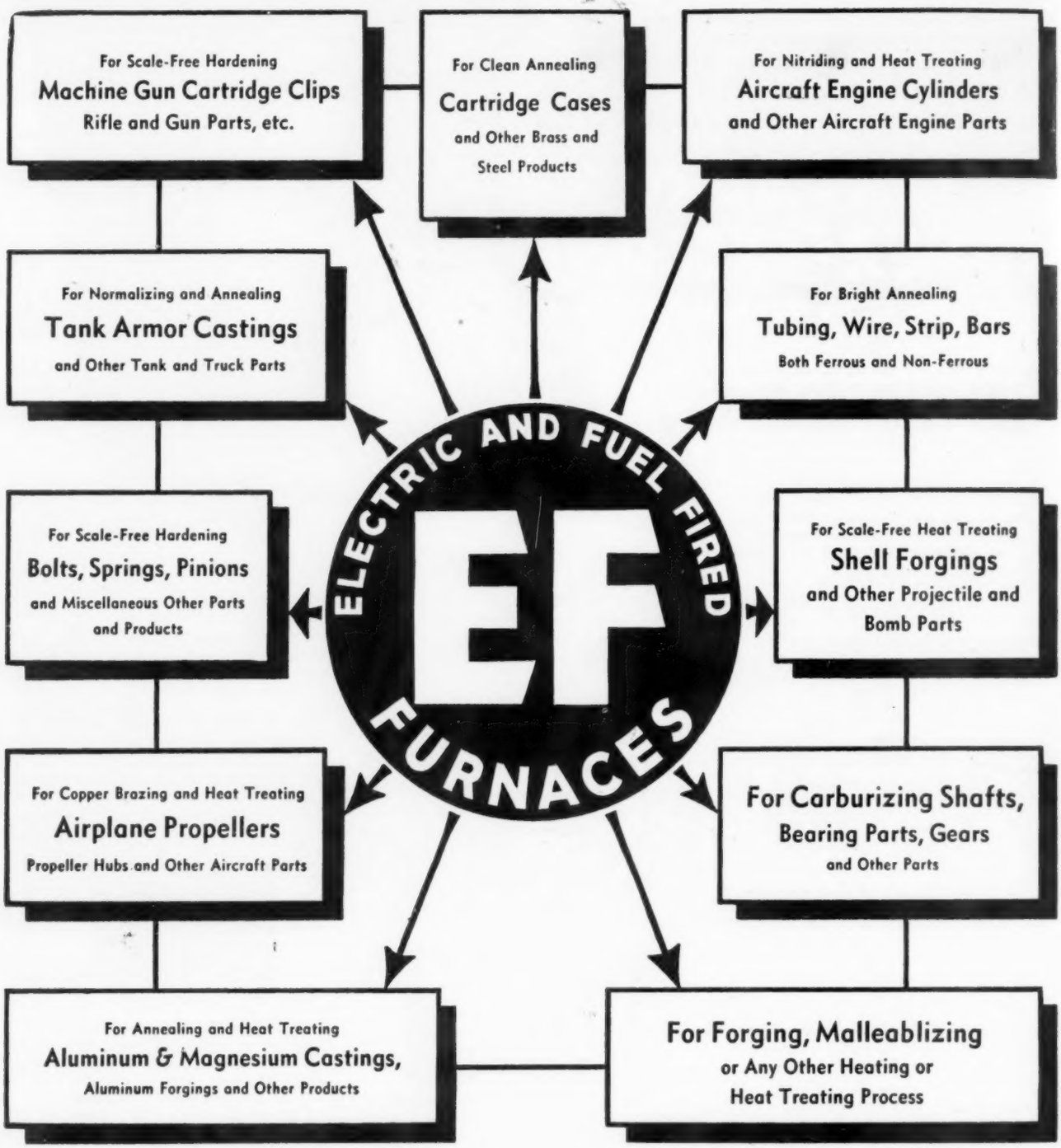
LINDBERG ENGINEERING COMPANY

2445 WEST HUBBARD STREET — CHICAGO, ILLINOIS

CYCLONE FOR LOW-COST ACCURATE TEMPERING

LINDBERG FURNACES

HYDRYZING FOR SCALE-FREE AND DECARB-FREE HARDENING



Increased production and uniformity; the saving of valuable time, labor and metals and other advantages have been effected by recent EF continuous automatic, semi-continuous and batch type furnace installations.

The Electric Furnace Co. specializes in designing and building production furnaces and time and labor saving material handling equipment. Years of practical furnace building experience has enabled EF engineers to develop some outstanding production furnaces for handling the above materials and many other essential war products.

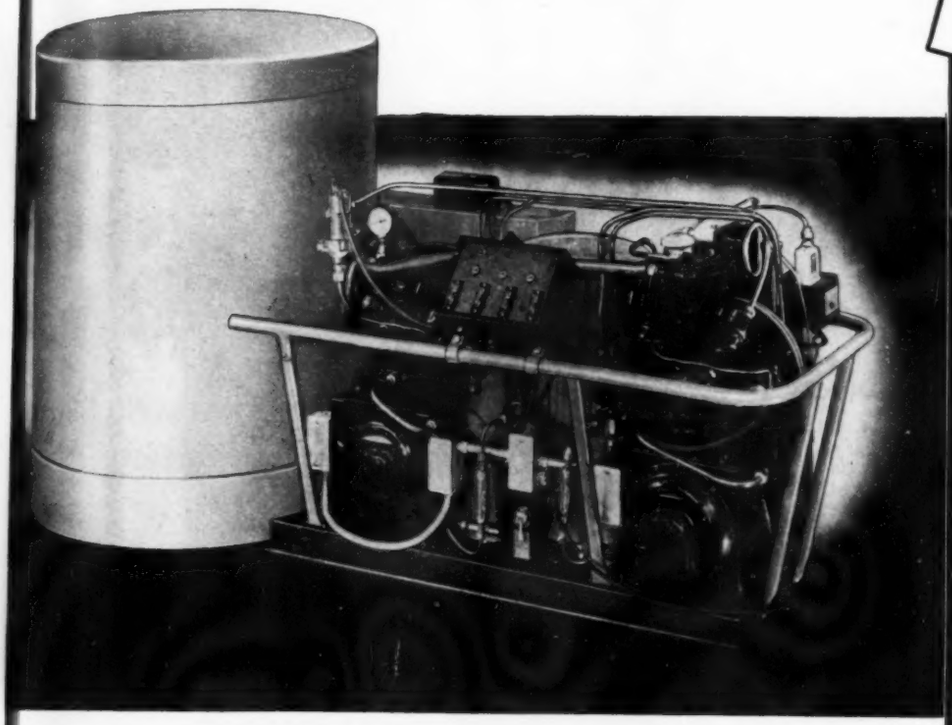
Submit *your* production furnace problems to EF engineers.

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces---For Any Process, Product or Production

Deepfreeze Metal Chilling serves you three different ways... effects savings up to $2825 per year over dry ice... removes 1000 B. T. U.'s per hour at —120° F.

SEE HOW IT'S DONE AT THE METAL SHOW
Visit our booth at the National Metal Exposition at Cleveland, October 12 through 16. Consult with our engineers—find how Deepfreeze can serve you in your present and future work.



THE DEEPFREEZE SANTOCEL CASCADE INDUSTRIAL CHILLING UNIT has a chilling chamber 24″ in diameter x 30″ deep —over 31 square feet of primary freezing surface. It is equipped with two motors and two compressors of the open silent-valve head, water-cooled, piston type. It has a heat absorbing capacity equivalent to 5¾ lbs. of dry ice per hour at same temperature and under similar operating conditions.

The same standard unit can be furnished 60″ deep, or deeper.

Special units can be furnished to suit specific applications. For instance:

A prominent aircraft manufacturer has been furnished with a special Deepfreeze Unit capable of producing a vacuum condition similar to that found at maximum flying altitude. It is provided with a transparent top and is used for testing flying instruments.

Another aircraft producer has been supplied with an extra deep unit for shrinking landing gear parts in assembly.

A blood plasma manufacturer uses a special Deepfreeze Unit for desiccating blood plasma. These are but a few of the many applications of Deepfreeze. It will serve you as well.

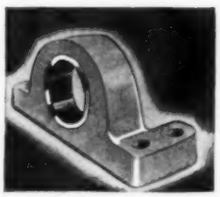
$2825 SAVINGS OVER DRY ICE!

Laboratory tests prove that the cost for removing 1000 B.t.u.'s per 24-hour day over a period of one year with dry ice will cost $3000.00, as against the $175.00 electric current consumption of the Deepfreeze over the same period of time.

Metal working industries' newest helper—the Deepfreeze Cascade Industrial Unit is saving time and money in practically every type of metal working plant in the country. It can also serve you in any one, or all three, of the following ways:

1 Shrinking of metal at *—100° F. to —120° F.* has made it possible to assemble bearings and similar parts requiring a press-fit, by merely slipping them into position...eliminates spoilage caused by "pounding" bearings into place...saves time caused by delay in replacing bearings...saves cost of expensive equipment.

Another application is in chilling aluminum alloy rivets 17S-T and 24S-T to retard aging. Rivets can be kept soft enough for driving for a period of over two weeks.



2 Testing of metals at *—100° F. to —120° F.* has made it possible to study the reactions of aircraft instruments to stratosphere flying. Aircraft engine lubricants can also be pretested for sub-zero flying. Tests are usually conducted over a 6 or 8 hour freezing period.

3 Treating of metal at *—100° F. to —120° F.* will produce combinations of hardness, strength and ductility not obtainable by ordinary hardening or tempering. For treatment of high-speed steel, temperatures colder than —150° F. are ineffective. Temperatures *warmer* than —100° F. are also ineffective. The Deepfreeze Cascade Unit is capable of maintaining —120° F., making it ideal for the proper treatment of high-speed steel.

DEEPFREEZE DIVISION
MOTOR PRODUCTS CORPORATION
2327 DAVIS ST., NORTH CHICAGO, ILLINOIS

FREE ADDITIONAL INFORMATION

and proof of the outstanding success of the Deepfreeze method for chilling metals is included in this booklet. Write for your copy today. Address...

DEEPFREEZE DIVISION, MOTOR PRODUCTS CORPORATION
2327 DAVIS ST.
NORTH CHICAGO, ILLINOIS

Name _____ *Title* _____

Company _____

Address _____

Less sharpening–Greater speed!

Conserves unnecessary oil waste

Metal-loaded cutting oils quickly dull cutting edges and build up a production resistance.

Sparkler Filters, with the Horizontal Plates, eliminate the finest metallic flakes that are most detrimental to the efficiency of all cutting and grinding operations.

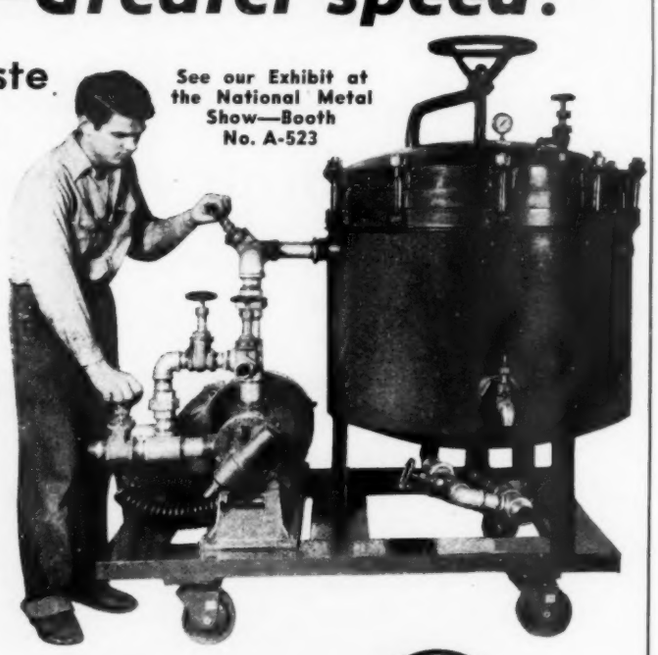
They restore turbid, gritty GRINDING OILS, CUTTING OILS, HONING OILS, TRANSFORMER OILS, PLATING SOLUTIONS, or any other liquid products, into bright, clear re-usable condition.

Sparkler Filters are easy to prepare, clean and operate. Sparkler microscopic particle filtration and purification make disinfectants more effective in controlling dermatitis.

SPARKLER MANUFACTURING COMPANY

274 LAKE STREET — MUNDELEIN, ILLINOIS

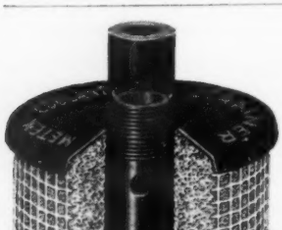
SPARKLER FILTERS
WITH THE HORIZONTAL PLATES



See our Exhibit at the National Metal Show—Booth No. A-523

Write for full details on what you have to filter. Our engineers are at your service.

SPARKLER SMC HORIZONTAL PLATE FILTERS



Overall dimensions Height 4-5/32", Diameter 4⅞"; ¾" Pipe and Nipple.

Metex Strainer in the Fluid (Sump) Tank.

Metex Disposable Cartridge or Refill.

STOP

HIDDEN SABOTAGE with this New COOLANT STRAINER with Disposable Cartridge

At last a tested and approved device that keeps cutting and lubricating solutions free of the metal cuttings and chips that sabotage your pumps. Saves wear-and-tear and costly shut-downs.

When filled with chips, strainer cartridge is simply replaced with inexpensive refill. Adaptable to both turret and engine lathes, automatic screw machines, milling and drilling machines. A real production booster Send for full information. Complete unit — $4.80 each. Cartridge, or Refill— $18.00 a dozen.

NOTE: We invite inquiries regarding any type of knitted metallic mesh for filter mediums, flexible metal fabrics, etc. Write Dept. AM-10.

METEX COOLANT STRAINER

METAL TEXTILE CORP., ORANGE, N. J.

THE JOHNSON FRICTION CLUTCH

Single

THE NEW "MAXITORQ" MULTIPLE DISC DESIGN.

. . for maximum serviceability in minimum space

The adaptability of JOHNSON FRICTION CLUTCHES to hundreds of different kinds of machines has been possible by the compactness of these sensitive durable units.

Many leading manufacturers of industrial machinery have standardized on JOHNSON CLUTCHES because their adoption involved minimum changes in design, and assured a maximum in clutch performance.

In addition to compactness, JOHNSON CLUTCHES offer quick, smooth starting. They are available for high speed, can be depended on for safety, durability and economy.

Let us show you how easy it is to engineer the JOHNSON CLUTCH into your machines. Just send us details of how you propose to apply the clutch. Ask for our assistance today.

Write for Multi-Disc Clutch Catalog No. 101 or consult Sweet's or Thomas' Register

Double

Has Floating Plates in Neutral

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

Philadelphia worm gears just naturally run quietly

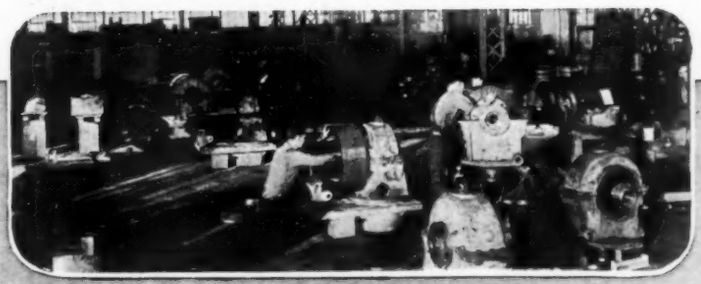
Quiet gear operation is a production aid because it indicates smooth, uniform running and higher efficiency, and of course they aid worker's output too as they are easier on the nerves. Philadelphia Worm Gear sets are designed to operate with a rolling action, not a sliding one, reducing friction and excessive heating. Furthermore they are made to last . . . to stand hard continuous usage . . . usually staying in service as long as the machine on which they are used.

Our gear Catalog tells more about these and others of the complete line of Philadelphia Gears. Write for a copy today.

PHILADELPHIA GEAR WORKS

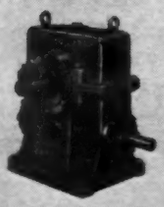
INDUSTRIAL GEARS
AND SPEED REDUCERS
LIMITORQUE VALVE CONTROLS

ERIE AVENUE & G STREET
PHILADELPHIA, PA.
New York, Pittsburgh, Chicago

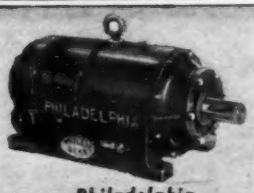


Philadelphia
LIMITORQUE CONTROL
operates all types of valves, etc., safely, economically, from convenient stations.

Philadelphia
GEARS
All types and sizes of industrial gears. Can be supplied in all materials.

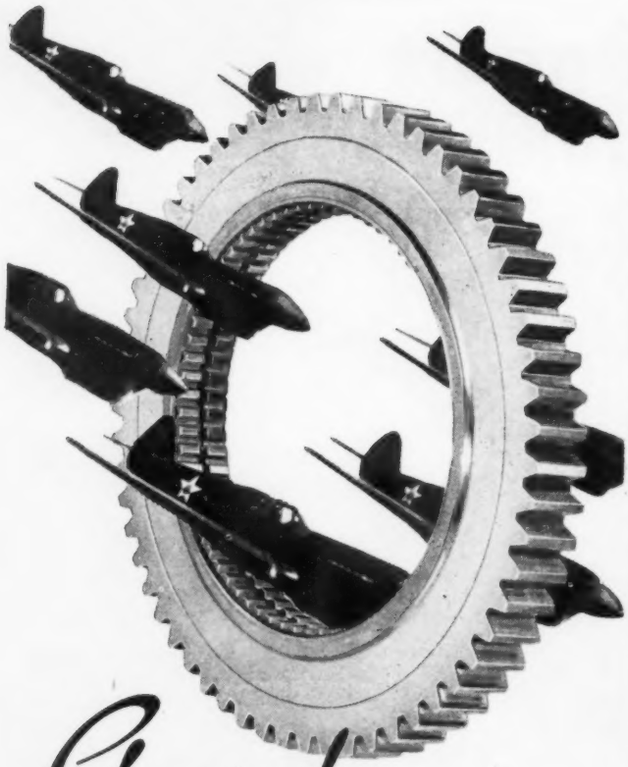


Philadelphia
WORM GEAR SPEED REDUCER
right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.



Philadelphia
MOTOREDUCER
The economical self-contained drive, Horizontal or Vertical types — various ratios and horsepowers.

Philadelphia
HERRINGBONE SPEED REDUCER
for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.



Geared

TO DO THE JOB

Common sense rules out the publication of specific facts and figures. But it's no secret that PERKINS GEARS are integral parts of airplane engines which power some of the deadliest fighters and bombers in the world.

Perkins produces every type of precision gear exactly to your specifications, from any material, in any quantity, for aircraft motors, precision instruments or any other equipment needed for Victory.

PERKINS PRECISION, CUSTOM-CUT GEARS

help power American Planes

PERKINS MACHINE & GEAR COMPANY

SPRINGFIELD, MASS.

"Throw Your Scrap Into The Fight"

"When your specifications call for special gears — Spur — Bevel — Mitres — Helical — Worms and Worm Gears — Reduction Units — Why not try GRANT.

You will find GRANT service meeting all requirements on both stock and special gears."

GRANT GEAR WORKS BOSTON

---a "DEGREE" in gear perfection

"Gears by Meisel" . . . These two letters signify thirty-three years of specialization in the art of gear design. They symbolize the *construction of gears for specific purposes* which, by their inherent accuracy, assure the highest possible degree of mechanical perfection. Lay your problem before a MEISEL Gearist to determine the *one* gear suited for your job.

An interesting brochure, entitled "Gear Craftsmanship," will be mailed FREE upon request.

MEISEL PRESS MFG. CO.

946 Dorchester Ave., Boston, Mass.

GEARED FOR VICTORY

Bevel-Spur-Worm-Helical

THE TAYLOR MACHINE COMPANY

1917 East 61st St. Cleveland, Ohio

"TAYLOR - MADE"

GANSCHOW GEARS

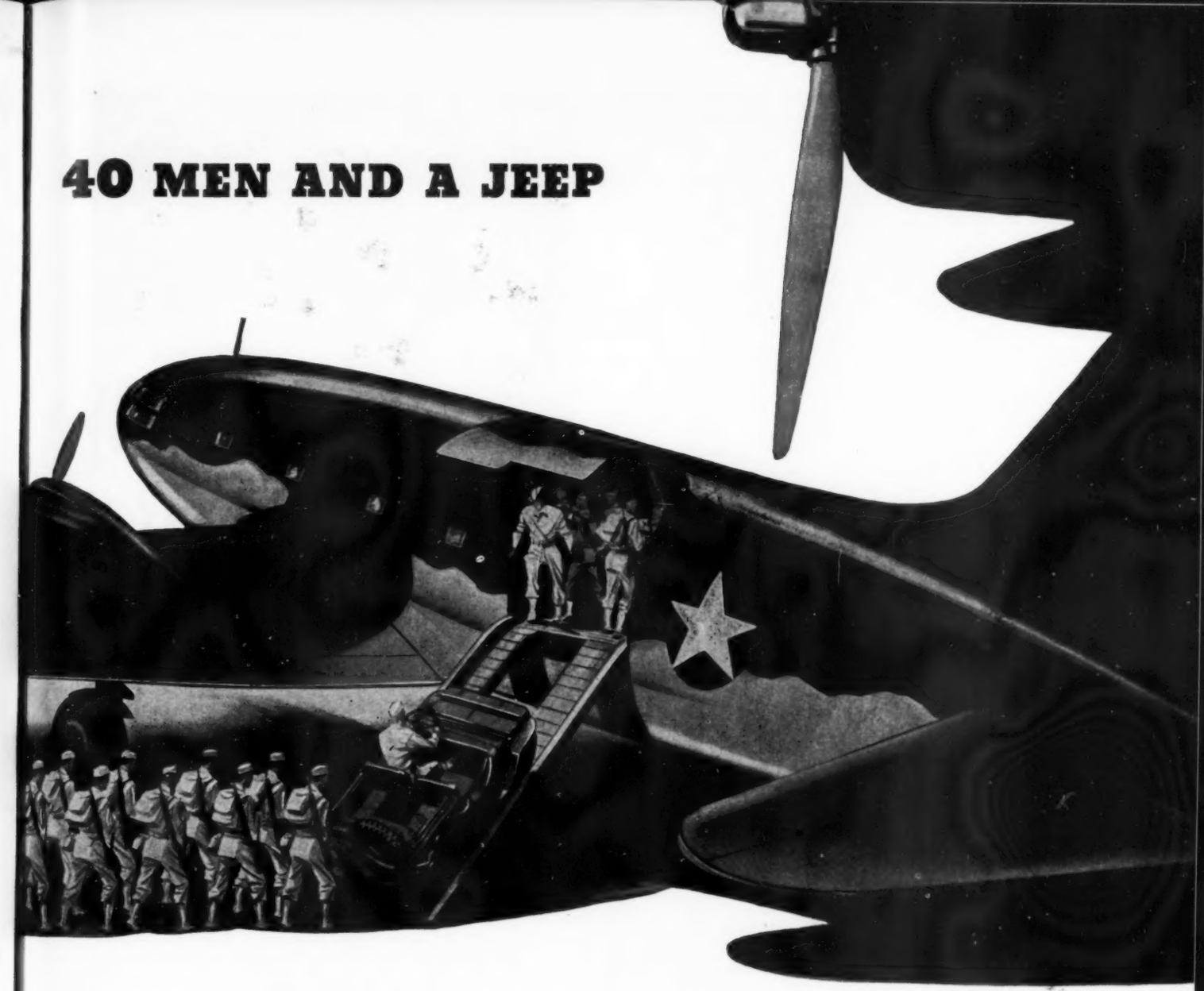
FOR SIXTY YEARS

Spur – SPEED REDUCERS – Worm

ALL TYPES OF CUT GEARS

GANSCHOW GEAR CO., 18 N. Morgan St., Chicago

40 MEN AND A JEEP



"GETTING there fustest with the mostest men" is still rule one for winning a battle. Today's wars depend upon the speed with which troops and their fighting equipment can be moved to the place where they are needed.

Rolling off production lines in America's great aircraft factories are huge freighters of the airways—planes as big as a boxcar that can span a continent between daylight and dark.

These leviathans of the air owe their tremendous carrying capacity as well as the speed with which they fly to the giant engines that power them.

To transmit the power of thousands of horses to whirling propeller blades, the gears in these engines must of necessity be held to such close tolerances that engineers have long considered them a laboratory product.

But laboratory methods of production could not be expected to furnish enough gears for the thousands upon thousands of fighting planes, bombers, and transports that are required to win a war.

The solution came in the production of gears of laboratory precision by mass methods, and today in the precision gear plant of Foote Bros., modern industrial might is helping solve the problem of more horsepower for engines—produced in ever-increasing quantities to meet war's insistent demands.

These new techniques—these new skills translated into post-war production mean that peacetime speed reducers and peacetime gears will assure better machines—quieter machines—that promise greater savings to American manufacturers.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 S. Western Boulevard • Chicago, Illinois

FOOTE BROS.

SPEED REDUCERS • GEARS • SPECIAL ASSEMBLIES

SEND US IMPORTANT DATA ON SPEED REDUCERS

Name _____

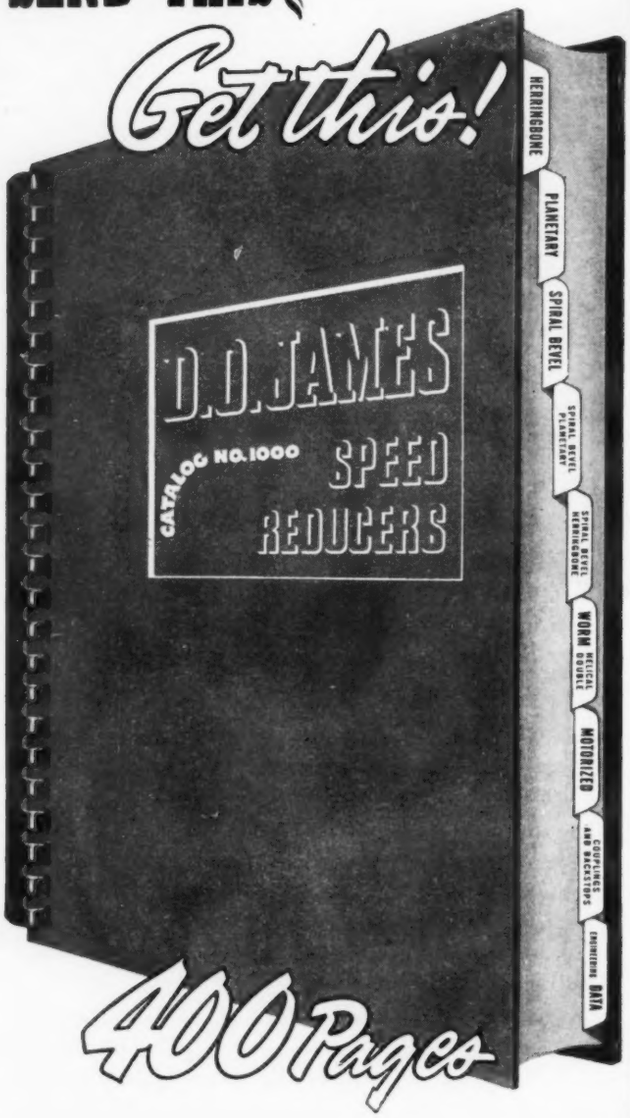
Address _____

City _____ State _____

MAIL TO D. O. JAMES MANUFACTURING COMPANY
1120 West Monroe Street, Chicago, U. S. A.

SEND THIS

Get this!



400 Pages

D.O.JAMES

of Information, Engineering Data covering application and examples for use on All Types of Speed Reducers. This permanent catalog record will be a positive aid to your engineering and purchasing departments.

MANUFACTURING CO., 1120 W. MONROE ST., CHICAGO, U.S.A.

OVER FIFTY YEARS MAKERS OF ALL TYPES OF GEARS AND GEAR REDUCERS

Why Not **TALK WITH US ABOUT YOUR GEAR PROBLEM?**

Yes, why not, when by outlining your requirements and telling us exactly what you need you'll receive sound advice based on our many years experience as gear specialists.

Write, phone or wire. We'd like an opportunity to talk with you—to tell you about our modern, complete facilities for producing gears of all types, sizes and materials—to show you how and why you'll save time and money by coming to Stahl and be assured of having your most exacting specifications carried out faithfully and economically.

Tell us what you need—ask us to quote. Our prices will interest you.

THE STAHL GEAR & MACHINE CO.
CLEVELAND • • • OHIO

GEAR CUTTING MACHINES

New Design
New Features
New Advantages

NEWARK GEAR CUTTING MACHINE CO.
69 Prospect Street, NEWARK, NEW JERSEY

FINE GEARS of All Types and Sizes
Spur Gears—½ in. to 20 ft. in diameter
Bevel Gears—½ in. to 13 ft. in diameter
Spiral Gears—½ in. to 10 ft. diameter
Worm gears in any practical size
THE EARLE GEAR & MACHINE CO.
4723 Stenton Ave. Philadelphia, Pa.
85 Liberty St. New York City

EARLE GEARS

BRAWNY GEARS
PROMPT
ECONOMICAL SERVICE
ALL TYPES, MATERIALS
AND QUANTITIES
Ask for Estimate

BRAUN GEAR CO., 1590-1608 Atlantic Ave., Brooklyn, N. Y.

THESE OHIO *Precision* GEARS

HELP TORQ-QUA-MATIC TRANSMISSIONS:

1. Provide lower machine operating costs
2. Reduce operator hazard and fatigue
3. Improve production and efficiency 25%

Among the first to manufacture individual, selective drive units for modernizing machine tools is the Torq Electric Mfg. Co. Their TORQ-QUA-MATIC Transmission provides the safe, low-cost, high-efficiency drive demanded by today's production.

Heart of the TORQ-QUA-MATIC is its OHIO Precision GEARS.

OHIO GEARS were selected by TORQ engineers for several reasons. First, their special alloy steel and precision cut insures long life and quiet operation. Second, OHIO GEAR Co. engineering assisted on several occasions in solving difficult transmission problems. Third, in emergency, the Company's service has frequently made it possible to meet unusual production and delivery requirements.

Numerous case histories show that these TORQ-QUA-MATIC individualized drives definitely decrease operator hazard and fatigue, and increase production as much as 25%.

Providing gears for individualized machine tool drives is another OHIO GEAR contribution to efficient, profitable power transmission.

THE OHIO GEAR CO.

1326 E. 179th Street • Cleveland, Ohio

*NEW YORK CITY, N. Y.
Patron Transmission Co.
154-156 Grand Street

NEW ENGLAND
George G. Pragst
332 Main St., Pawtucket, R. I.

*LOS ANGELES, CALIF.
J. W. Minder Chain & Gear Co.
927 Santa Fe Avenue

GRAND RAPIDS, MICH.
W. H. Slaughter
1924 Madison Ave., S. E.

*PITTSBURGH, PA.
Standard Machinists Supply Co.
South 2nd and McKean Street

DETROIT, MICH.
George P. Coulter
322 Curtiss Building

**Stocks carried.*

*MINNEAPOLIS, MINN.
Industrial Supply Co.
717 S. Eighth Street

BUFFALO, N. Y.
F. E. Allen, 2665 Main St.

*KANSAS CITY, MO.
Kansas City Rubber & Belting Co.
712 Delaware Street

*SAN FRANCISCO, CALIF.
Adam-Hill Co.
244-246 Ninth St.

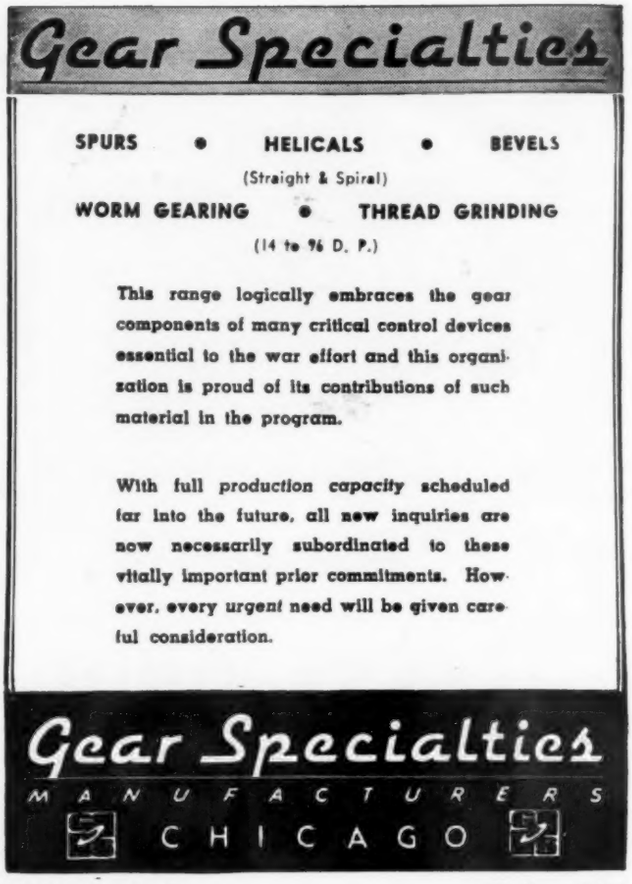
LOUISVILLE, KY.
Alfred Halliday, 330 Starks Bldg.

*INDIANAPOLIS, IND.
A. R. Young
715 Fort Wayne Avenue

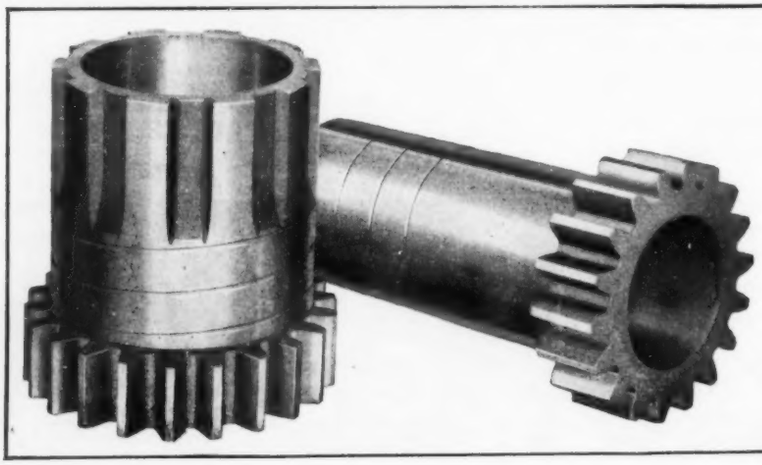
ST. LOUIS, MO.
St. Louis Tool Co.
2319 N. Ninth Street

OHIO GEARS

BUILT TO DO A JOB
Cincinnati Gears are engineered to meet the production requirements of TODAY. Improved Cincinnati Gear techniques, plus modern equipment, are setting new standards of machine performance at many plants.
Forty years of specialized experience in building custom gears, makes Cincinnati Gear Company well fitted to produce "Gears . . . Good Gears Only".
Designed with special tooth form for quiet and efficient operation.
THE CINCINNATI GEAR COMPANY
"Gears . . . Good Gears Only"
1825 Reading Road • Cincinnati, Ohio


Gear Specialties
SPURS • HELICALS • BEVELS
(Straight & Spiral)
WORM GEARING • THREAD GRINDING
(14 to 96 D. P.)
This range logically embraces the gear components of many critical control devices essential to the war effort and this organization is proud of its contributions of such material in the program.
With full production capacity scheduled far into the future, all new inquiries are now necessarily subordinated to these vitally important prior commitments. However, every urgent need will be given careful consideration.
Gear Specialties
MANUFACTURERS
CHICAGO
2600 W. Medill Av.
Ph. Hum. 3482

GET YOUR QUOTATION
from "HARTFORD"
GEARS of every description cut to order
GEAR, CAM and THREAD grinding
AERONAUTICAL PARTS on contract basis
Send blue prints or samples for estimate. Accuracy of work guaranteed to your specifications.
THE HARTFORD SPECIAL MACHINERY COMPANY
HARTFORD CONNECTICUT


ADAMS
GEARS
SPUR — HELICAL — WORM
BEVEL — MITER — RACKS
Splined Shafts A Specialty
THE ADAMS COMPANY
Est. 1883
1942 Bridge St. Dubuque, Iowa

How to save time by doing more reading

That is a profitable paradox for you. More true today than perhaps ever before. For here in the pages of this publication are packed many helpful ideas . . . considerable useful information. Much of it, in fact, available from no other source.

And we most emphatically mean *both* the editorial and the advertising pages.

Just one new idea gleaned from these pages . . . a method for doing something better or faster or easier or at lower cost, may alone save you far more than a year's reading-hours invested in this and other worthwhile business papers.

Many people have found this a fact . . . not only once, but time and time again. That's significant . . . with time so precious today.

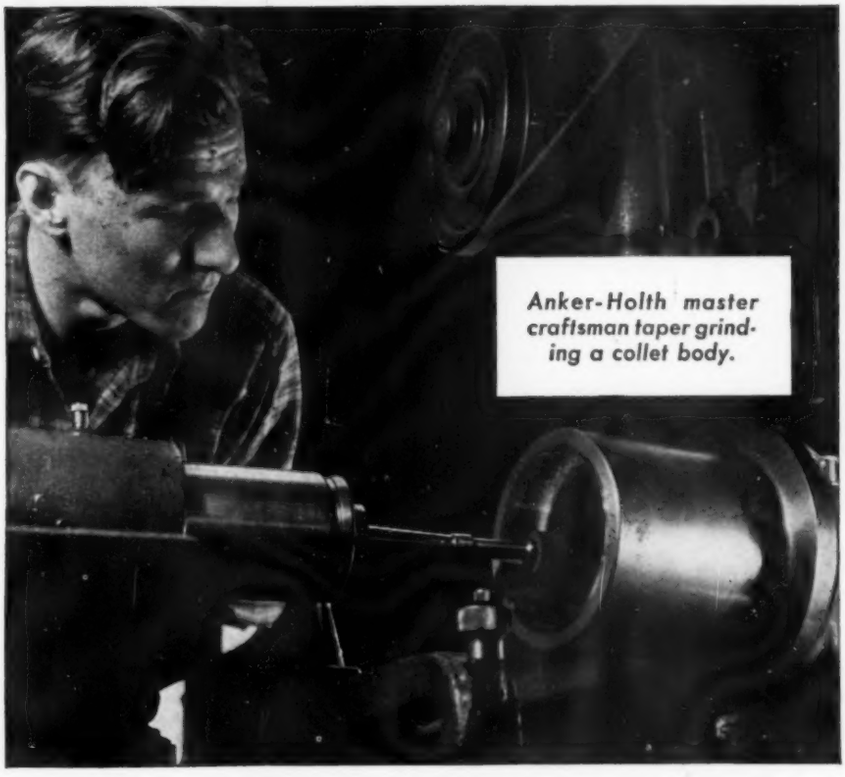
★

Good advertising speeds information from those who have it . . . to those who need it.

★

McGraw-Hill Publishing Company, Inc.

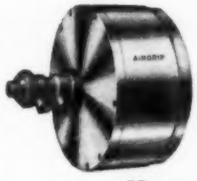
330 West 42nd Street New York



Anker-Holth master craftsman taper grinding a collet body.

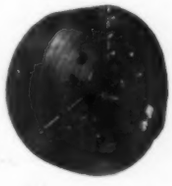
PRECISION Air Chucking Devices

Anker-Holth "Airgrip" Chucking devices are precision made by master craftsmen. Built into every air cylinder and chuck are—long life and efficient operation, which assure lower cost and faster production.



Double ball bearings in Model D Anker-Holth revolving air cylinders reduce friction to the minimum and permit speeds heretofore impossible.

Heavier cuts, courser feeds and faster production are attained with Anker-Holth "Airgrip" Chucks. Work may be chucked or released without stopping the machine.



Anker-Holth makes a complete line of expanding arbors and collet chucks for projectiles from 20 mm. up to 155 mm. At left—155 mm. collet chuck.

Other Anker-Holth products: Revolving cylinders for feeding bar stock through spindle; three-jaw universal chucks; special "Airgrip" arbors; parallel grip collet chucks; operating valves; and, air filter, automatic lubricators, and regulating valves. Also, hydraulic cylinders.

Wire, or phone, for shipping dates!

Anker-Holth Mfg. Co.

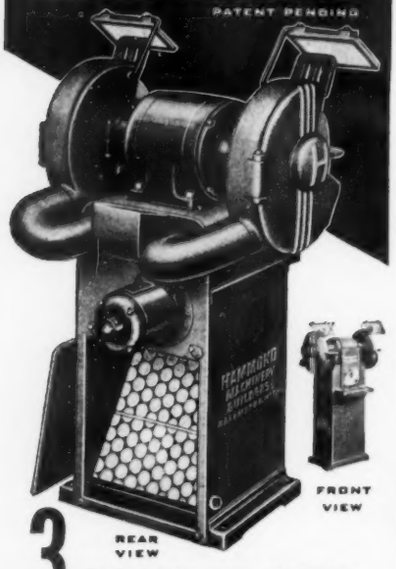
"AIRGRIP" CHUCK DIVISION

332 So. MICHIGAN AVE. • CHICACO. ILL.

Hammond
OF KALAMAZOO

NO-DUST* GRINDERS

PATENT PENDING



3 POPULAR SIZES

FOR 10", 12", 14" WHEELS

*COMPLETELY SELF-CONTAINED GRINDER AND DUST COLLECTOR

SAVE SPACE—No-Dust Grinders require 6½ sq. ft. where average grinder and independent unit takes almost 15½ sq. ft.

SAVE TIME—It's self-contained, set up near electrical outlet, put it to work; no other connections needed.

SAVE "MAN-HOURS"—Protect employees' health—keep 'em producing.

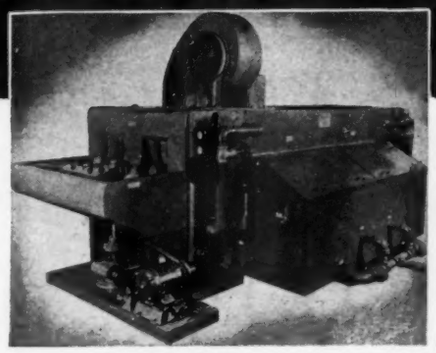
VISIT OUR BOOTH D-122 METAL SHOW CLEVELAND OCT. 12-16

Models Available
ND-10, ND-12, ND-14

Write for
BULLETIN GP-13

Hammond
MACHINERY BUILDERS
1618 DOUGLAS AVENUE
KALAMAZOO, MICHIGAN
Eastern Branch, 71 W. 23rd St., N. Y. C.

Three Vital Factors in Wartime Metal Cleaning..



Magnus Shell Washing Machine using Magnus Supersil O for washing, rinsing, drying and cooling 75 mm shells, at less than ½c per shell.

METHODS MATERIALS MACHINES!

In war time, you can't consider the cleaning method independently of the metal washing machine or the cleaning material. Smooth, high-speed production depends upon the right machine and method. Effective cleaning depends upon the cleaning material—but it must be adapted to the method and the machine.

MAGNUS—A *COMPLETE* SERVICE

Put your metal cleaning problems up to Magnus for a complete solution.

Now you can get the machine best fitted to tie in with your production flow sheet and the cleaning material best suited to your particular products from one organization, geared up to consider your cleaning problem as a whole.

Magnus Materials and methods, used in a Magnus-designed washing machine specifically built for your own metal cleaning operations, insure maximum production, rigid adherence to quality standards and low overall costs.

MAGNUS CHEMICAL COMPANY

Manufacturers of Cleaning Materials, Industrial Soaps, Metallic Soaps, Sulfonated Oils, Emulsifying Agents and Metal Working Lubricants.

60 SOUTH AVENUE GARWOOD, N. J.
Industrial Cleaning Consultants in All Principal Cities

MAGNUS CLEANERS

MOVING?

If you plan to change the address to which your copies of *American Machinist* are sent, let us know now. We don't—and we're sure *you* don't—want a single issue to be delayed in reaching you. Coupon below for your convenience.

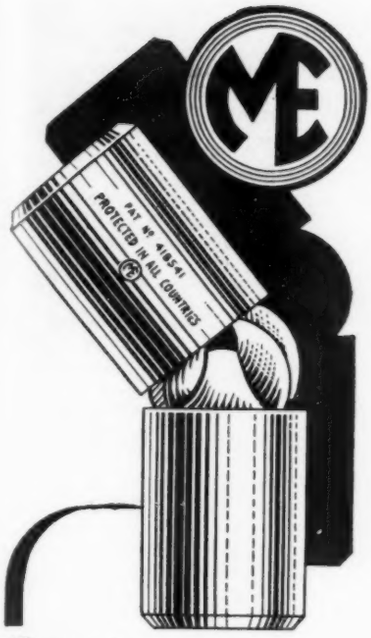
AMERICAN MACHINIST • 330 W. 42 ST., NEW YORK

MY OLD ADDRESS

Name .....
Title .....
Company .....
Address .....
.....

MY NEW ADDRESS

Name .....
Title .....
Company .....
Address .....
.....



Patent

UNIVERSAL BALL JOINTS

- Made in a range of 9 sizes for shaft diameters ¼" to 1⅛".
- Standard Joints have maximum angle of 38° from the straight line.
- Made by the largest manufacturers of UNIVERSAL JOINTS in Great Britain.
- Widely used in Machine Tools, accessory drives and on Aircraft.
- Certified 92% to 98% efficient by the British Government's National Physical Laboratory.

Catalogues on request.

The

MOLLART

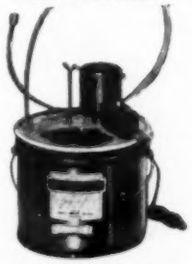
Engineering Co.,Ltd.

KINGSTON BY-PASS, SURBITON, SURREY, ENGLAND.

Telegrams: PRECISION, SURBITON.

Gray-Mills *Portable* COOLANT SYSTEMS

Above is shown an interior view of Model G-2A —note baffle plate construction and forced settling fixture that aids in keeping coolants free from abrasives



Pump Model G-2, above, has a capacity of 75 gal. per hour — capable of supplying ample flow for small machine tools or up to 4 spindle drill presses.

Visit the Gray-Mills booth No. B-418 at the Metals Exposition and see Gray-Mills Coolant Systems operating.

THE advantages of coolants:—increased production and time-and-tool savings—are being used more and more in the metal working industry. One reason is that Gray-Mills Portable Coolant Systems make it easy and economical to apply coolants to *every machine*—small, large and special. For example; many Sunnen Precision Honing Machines like those above, are rapidly turning out super-smooth precision parts at maximum efficiency — and good coolants properly applied through a Gray-Mills Model G-2A System help them do their best.

Whether your problem is modernization of older machines; equipping small, large and special tools for greatest efficiency; or a standby system for emergency, put a Gray-Mills Portable Coolant System to work. You will increase production and save time and tools.

There is a complete range of pump sizes, from 50 to 165 gal. per hour, and pans, valves and fittings for your applications. Prices range from $39.50 to $99.50. *Phone your distributor— or wire or write direct.*

FLO-BAC COOLANTS

Gray-Mills Complete Coolant Service includes the Flo-Bac line of quality cutting fluids. Four types to cover practically every requirement. Available in 3 gal. to 55 gal. wood or steel containers. Immediate delivery from your distributor or our plant.

GRAY-MILLS

COMPLETE PORTABLE COOLANT SYSTEMS
FLO-BAC COOLANTS, PANS AND FITTINGS

GRAY-MILLS CO., 227 W. Ontario St., Chicago, Ill.

Amazing!

how WALLUSTRE hides

MAINTENANCE, with a minimum of interruption to operating schedules, is of utmost importance today. That's why the Devoe Laboratories developed Extra-Hiding High Gloss WALLUSTRE, the modern paint that **does the job in just one coat.**

Another reason why maintenance engineers specify WALLUSTRE for all interior wall surfaces is that its lasting whiteness insures proper reflection and diffusion of every bit of light available.

Eight outstanding advantages make WALLUSTRE the maintenance paint for you to specify for your plant:

1. One-coat hides black.
2. Amazing initial whiteness.
3. Stays white longer.
4. Modern synthetic vehicle.
5. Tough — long lasting.
6. Brushes smoothly — easy to apply.
7. Ideal for spray application.
8. Economical — high spreading rate.

If conditions in your plant indicate a paint with high resistance to moisture, fungi or fumes, your Devoe Maintenance Representative can help you select the specialized type you need.

Write today for pamphlet WL-18 describing the complete Devoe Wallustre Maintenance Paint Line.

By improving sight with paint you help the National Safety Council's drive to reduce accidents and you build better morale among the workers in your own establishment.

DEVOE & RAYNOLDS CO., INC.

The 188th year of the oldest paint-maker in America

FIRST AVENUE AT 44th STREET, NEW YORK, N. Y.

Working with

UNFAMILIAR *and* DIFFICULT MATERIALS?

★ October 5, 1938, *American Machinist* inaugurated its regular series of "Working of Materials" sections. These familiar, and highly respected "blue sections", compacted from suggestions and practices of authorities in each field, are now used extensively by Metal-Working plants busy on armament orders.

Each details characteristics of a particular material, or group of materials, and gives latest practical data on fabrication. They will help you—and are typical of the useful and exclusive editorial content that *American Machinist* brings you fortnightly.

Over 115,000 reprints have been requested, exhausting our stocks on a number of subjects. Those listed below, however, are still available although stocks on some are limited. If you want extra copies, order *now* while our supply lasts.

1 **Working of Aluminum Alloys**
2 **Working of Magnesium Alloys**
3 **Working of S A E Nickel Alloy Steels**
4 **Working of Nitriding Steels**
5 **Alternate Steels for Emergency Use**
6 **Working of Carbon Sheet Steel**
7 **Working With Cutting Oils**

15 Cents per copy as long as our limited supplies last

MAIL COUPON . . NOW

Please send me at once the following special "Working of Materials" sections from AMERICAN MACHINIST. I inclose 15 cents (stamps, money order or check) for each section ordered.

1 2 3 4 5 6 7

(order by circling number)

NAME

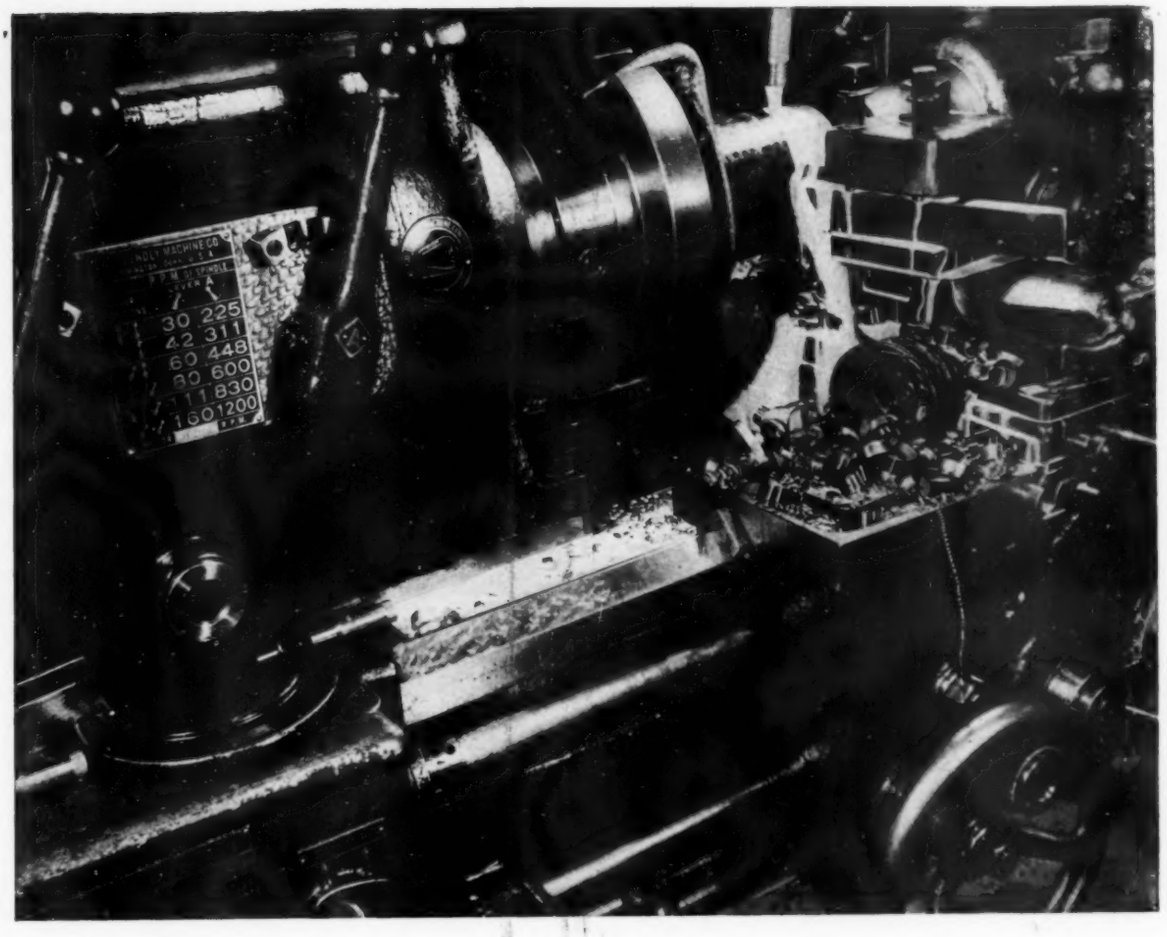
TITLE

COMPANY

ADDRESS

American Machinist

330 West 42nd St., New York



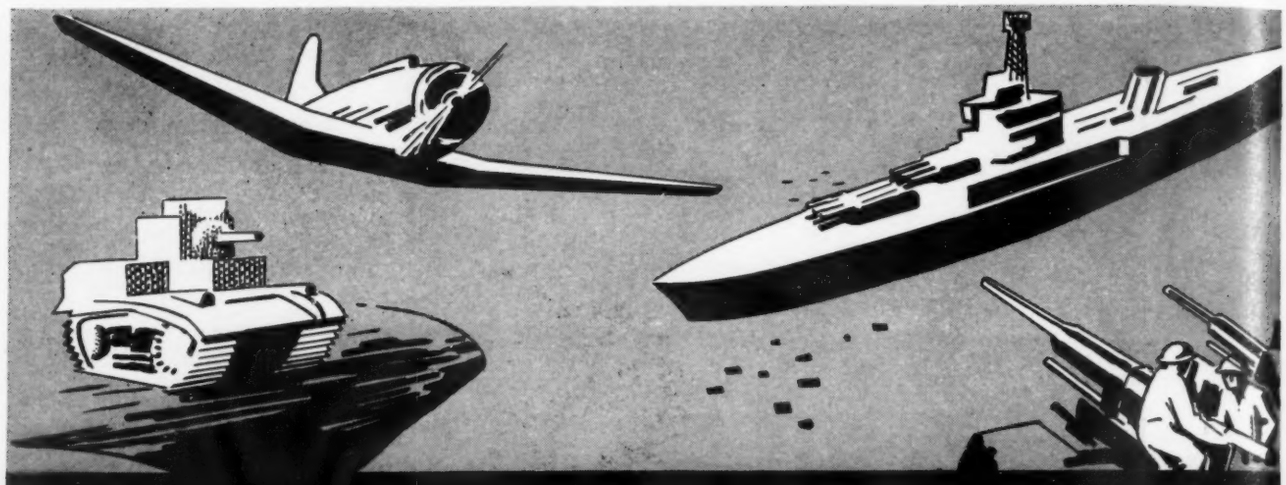
HENDEY

Most of the Hendey lathes going into service are working on a 24 hour basis. This is a difficult task for any machine tool but Hendey lathes are standing up to the ordeal without any signs of weakness or failure.

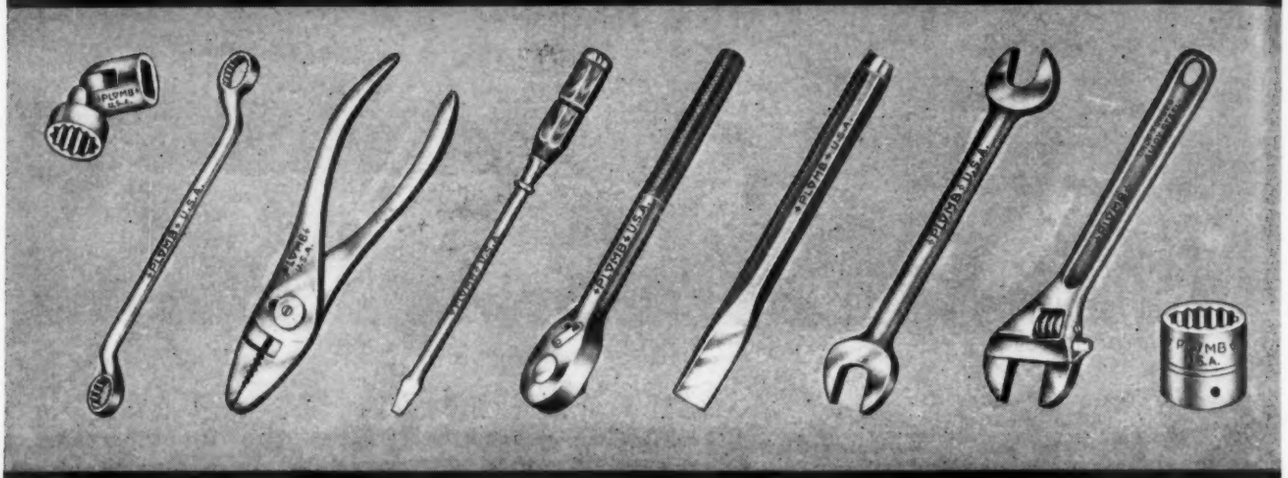
THE HENDEY MACHINE COMPANY

TORRINGTON, CONN., U. S. A.

BOSTON • NEW YORK • ROCHESTER • DETROIT • CHICAGO



Weapons like these –



are kept operating with tools like these

The Plomb Tool Company is one of the world's largest manufacturers of fine forged hand tools

PLOMB TOOL COMPANY • LOS ANGELES, CALIFORNIA

To meet war needs
31
FACTORIES
make them

PLOMB
Streamlined Tools

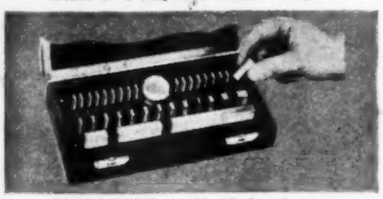
. . . FOR PRODUCTION INSPECTION

OTHER INSTRUMENTS IN THE SCHERR LIMITED BUDGET INSPECTION LABORATORY

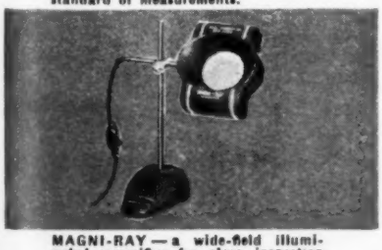
SPENCER BINOCULAR MICROSCOPE with 3 dimensional vision, reveals surface finish, imperfections, etc.

SCHERR COMPARITOL for checking gage blocks, gages and work for size, accuracy and wear.

WILDER PROJECTOR for accurate measuring or comparing objects by means of a magnified shadow image.



ULTRA-CHEX—a 34 block set accurate to .000008"—providing a basic standard of measurements.



MAGNI-RAY—a wide-field illuminated magnifier for close inspection of work and operations.

ACCURATE GAGING

NOT DEPENDENT ON MEASURING SKILL

The demand for closer tolerances at a time when skilled mechanics and toolmakers are difficult to obtain, makes the use of snap gages a practical necessity for accurate measurement of mass produced parts.

Through the use of ATLANTIC ADJUSTABLE LIMIT SNAP GAGES, accuracy in checking is made possible without dependence on the operator's skill or "feel" on which other measuring instruments depend for precise inspection. Once set, practically any operator can tell by the "GO" and "NO GO" parts of the ATLANTIC SNAP GAGE whether the part under inspection has been produced to the correct, specified limits. Faster inspection as well as more accurate results are assured—production as well as assembly can be stepped up.

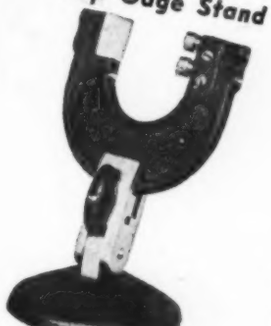
ATLANTIC ADJUSTABLE LIMIT SNAP GAGES are manufactured in a modern gage and instrument shop with special machinery and tools and under proper atmospheric conditions for the finest machining, grinding and lapping. Gaging pins and anvils are hardened, ground, carefully lapped and must pass rigid tests for flatness and parallelism. Castings are of MEEHANITE to assure the maximum in rigidity and permanence of form and accuracy.

MADE IN THE FOLLOWING RANGE OF SIZES

Model A—in 10 Frame sizes and in size ranges from 0—1/2" to 5 1/4—6" inclusive.
Model B—in 19 sizes ranging from 0—1/4 to 5 5/16 to 5 11/16".

Write, wire or telephone (Canal 6-1464) for quotations and delivery dates.

SCHERR
Snap Gage Stand



This stand provides a vise or clamp for holding micrometers, snap gages and other tools. It eliminates errors due to body heat and frees both hands for checking work. Greater accuracy and speed in inspecting as well as less fatigue are important advantages resulting from the use of SCHERR TOOL STAND. Price $7.50. Order Today!

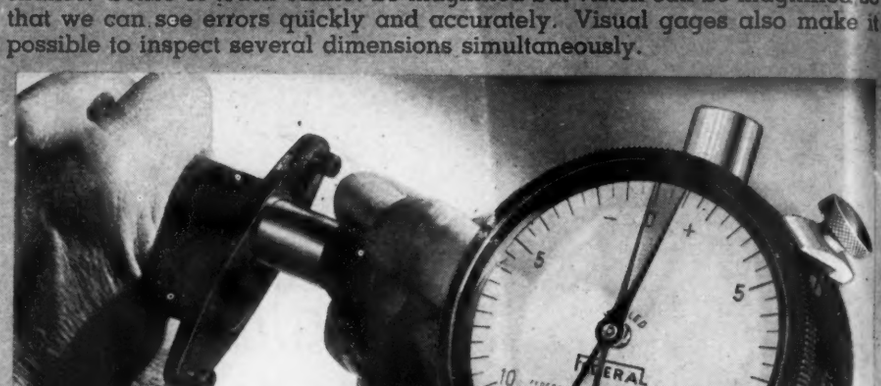
Send for detailed specifications

GEORGE SCHERR COMPANY, INC. 124 LAFAYETTE ST., NEW YORK, N.Y.

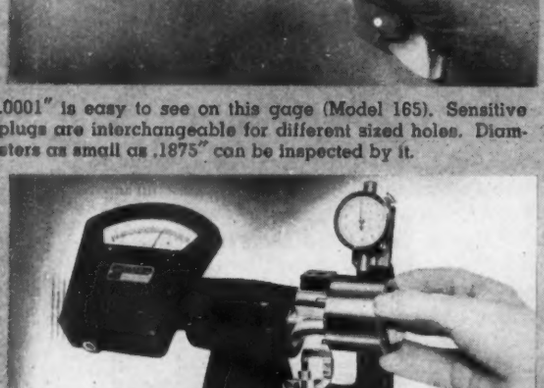
HOW TO SEE ERRORS IN DIMENSIONS.

To see errors in dimensions as small as only .0002" or even as large as .002" by depending upon one's sense of touch alone is leaving a great deal to chance. Sense of touch cannot be magnified but vision *can be* magnified so that we can see errors quickly and accurately. Visual gages also make it possible to inspect several dimensions simultaneously.

.0001" is easy to see on this gage (Model 165). Sensitive plugs are interchangeable for different sized holes. Diameters as small as .1875" can be inspected by it.



"Feeling" a tolerance of even .002" is not as quickly determined as by a glance at a needle movement of approximately 3/16".



Visual or Dial Indicator Type Gages enable you to inspect several dimensions simultaneously and to determine the relationship of dimensions with each other. Here concentricity of the outside diameter is checked with the inside diameter. The lower indicator checks the squareness of the end with the axis of the inside diameter and the latter is checked for its own accuracy of diameter, roundness and taper. Try to do this with a "fixed" gage.

These are typical of many other possibilities well worth your investigation. Practically any detail can be inspected for accuracy of dimension — Inside, Outside, Offset, Alignment or Position and Profile. Ask for further information.

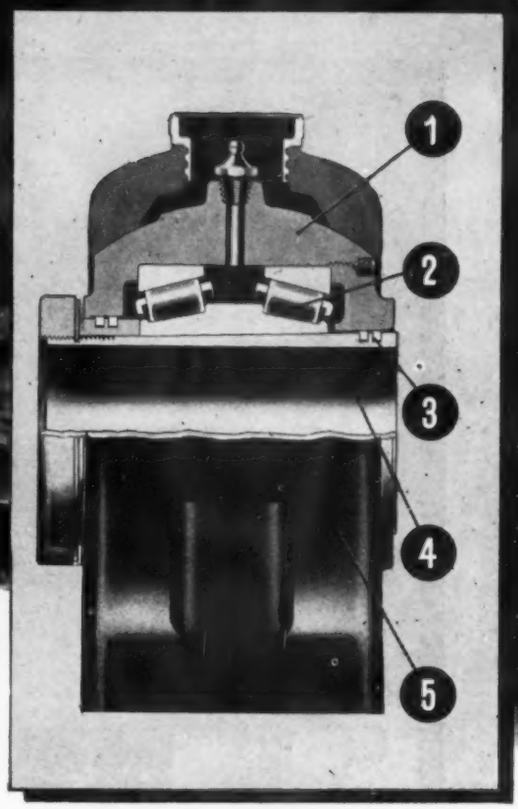
FEDERAL PRODUCTS CORPORATION
PROVIDENCE **RHODE ISLAND**

Here .00005" is magnified to look like 3/32". Considerable training is necessary to acquire skill for *feeling* such precision. The weight of the workpiece doesn't influence the reading as the contact is on the underside of the interchangeable plug. The gage is Model No. 1202 B-6.

★ ★ ★ ★ ★ **FEDERAL** ★ ★ ★ ★ ★

PRECISION MEASURING INSTRUMENTS

Chicago • Cleveland • Detroit • Hartford • Los Angeles • Milwaukee • Montreal • Muncie
New York • Philadelphia • Pittsburgh • Rochester • San Francisco • St. Louis • Toledo • Toronto • Wind



PUT *ALL* YOUR POWER IN THE JOB

All power in production *now* means more air power, fire power, battle power for fighting men in the air, on the sea, and on the land, sooner and faster. It is the Victory formula for shortening the war.

Dodge Rolling Bearings installed on your products get more battle power from horsepower. They insure equipment the opportunity to perform up to full capacity by putting all power in the job. Easily and economically installed, Dodge Bearings save power from wasting itself battling friction—give motors the opportunity to put all their power into the job of production. Lubricant is locked in Dodge Bearings by indestructible steel seals, that pass all power through but shut out destructive substances.

Dodge Rolling Bearings are rugged—carry heavy loads and resist shocks—permit high speed operation—insure continuous performance. They reduce wear and maintenance, prolong life of machinery. Seals exclude dust, dirt and water, remove danger of damage to product through oil leakage. 50,000,000 revolutions can ordinarily be expected with one greasing. They provide dual load carrying capacity capable of accommodating both radial and thrust loads — simplify design of machinery — permit standardization and allow interchangeability.

Dodge Bearings are available in a wide selection of types and sizes, suitable for all service conditions.

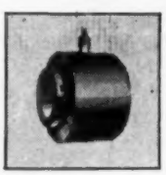
Dodge Distributors specializing in "The Right Drive for Every Job" provide industry with a source of supply from local stocks, including alternate selections.

DODGE MANUFACTURING CORPORATION, *Mishawaka, Indiana, U. S. A.*

Dodge-Timken Special Duty Ball and Socket Pillow Block.

Dodge-Timken Special Duty "S 1" Pillow Block.

Dodge-Timken Special Duty "D" Unit Mount.



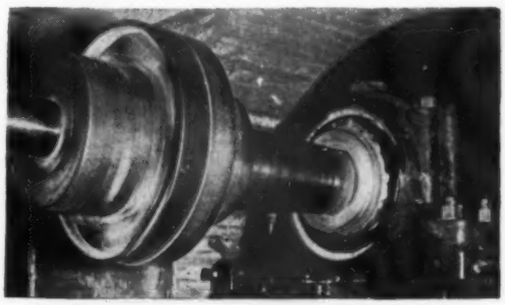
Dodge-Timken Special Duty "B 1" Unit Mount.

Dodge-Timken Special Duty "S 1" Unit Mount.

DODGE
MISHAWAKA

THE RIGHT DRIVE FOR EVERY JOB

1. Full ball and socket self alignment saves wear and power waste — simplifies installations.
2. Timken tapered roller bearings give full radial and thrust load capacity, vital to putting all the power in the job.
3. All-metal automotive type piston ring seals keep grease in and dirt out—close the bearing tight to foreign substance but leave it wide open to passage of power.
4. Long split adaptor sleeve distributes load over entire length of bearing — reduces pressure per square inch on shaft and eliminates peening action which causes rapid wear.
5. Rugged, well proportioned outer housing gives over-all protection to bearing.



Faced with the problem of immediately stepping up production, putting more power in the job, a North Carolina textile mill reports that Dodge-Timken Special Duty Bearings (shown above) helped solve the problem of power transmission modernization quickly and economically.

Dodge-Timken Special Duty Pillow Blocks are reducing both power and maintenance costs in this West Coast lumber mill installation. The ability of Dodge bearings to absorb shock loads and smoothly cushion power is saving materials and power every day.

POWER *Dives* BEGIN WITH POWER *Drives*

"Commercial" ANNULAR BALL BEARINGS

EFFICIENCY • ACCURACY • ENDURANCE

USED IN HUNDREDS OF DIFFERENT PRODUCTS

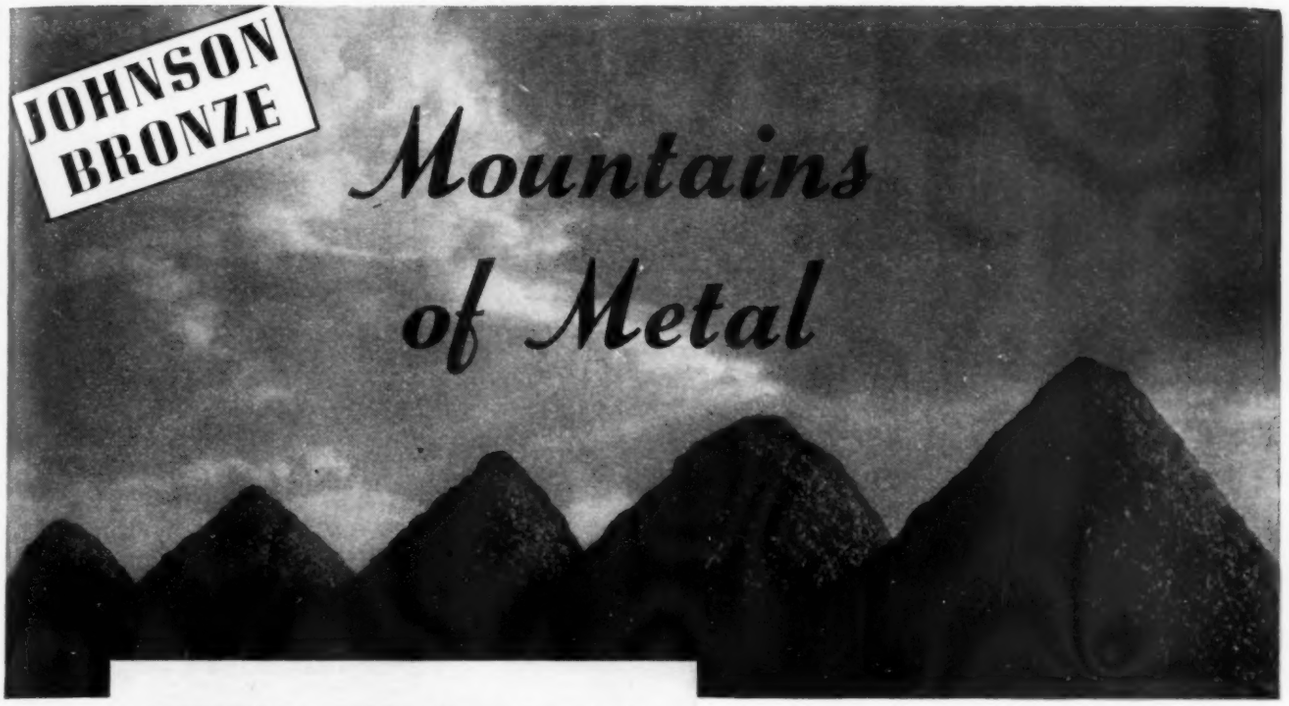
WE supply ball bearings for every industrial purpose—standard types, or bearings designed for unusual installations.

SCHATZ **"Commercial"** Bearings are made from high-grade steels, carefully heat-treated. They have the capacity, strength and endurance essential to long bearing life and efficient service.

On this page, we illustrate **"Commercial"** bearings of unusual design—a few of hundreds of different types manufactured by us. These illustrations convey some idea of our skill and ability in solving intricate ball bearing problems.

ENGINEERS AND MANUFACTURERS WHO DESIRE FURTHER INFORMATION REGARDING SCHATZ **"Commercial"** BEARINGS ARE REQUESTED TO WRITE FOR LATEST CATALOG.

THE SCHATZ MANUFACTURING CO.
U. S. A.
REPRESENTATIVES LOCATED AT
Detroit: 2640 Book Tower • Chicago: 902 S. Wabash Ave.
Cleveland: 402 Swetland Bldg. • Los Angeles: 5410 Wilshire Blvd.



EVERY TIME you purchase Bearing Bronze in the "rough", you buy at least 25% more metal than necessary. Quality bearing bronze contains copper, tin and lead . . . metals that are vital to our war effort. When your purchases amount to tons, you actually remove *mountains of metal* from the active market.

You can easily avoid this waste . . . get a higher quality product . . . save many hours of machine time by specifying Johnson UNIVERSAL Bronze. Every Johnson bar is completely machined—I.D.—O.D.—ENDS. Our range of over 350 stock sizes enables you to buy according to your needs. Why not start today to help conserve metal? Your local Johnson Distributor can give you excellent service. His name will be found in your telephone book.

that could help WIN the WAR

JOHNSON BRONZE

Sleeve Bearing Headquarters

515 SOUTH MILL STREET • NEW CASTLE, PA.

LINCOLN PARK CARBOLOY GAGES

These are Carboloy gages, and are typical of the wide variety of gages produced from this material by Lincoln Park.

Give You At Least

50 TIMES THE INSPECTION USEFULNESS OF ORDINARY STEEL GAGES

Multiply the gages shown above by fifty. That would be the minimum number of similar steel gages required for the same inspection purposes.

For high production inspection, it is a definite contribution to the War Effort to specify wear-resistant gages. When Lincoln Park Carboloy gages are used, production capacity, which could be tied up in the manufacture of great numbers of steel gages is released. Production of other urgently needed types of gages increases . . . deliveries of all gages are speeded up considerably.

Of special importance to you, Lincoln Park Carboloy gages can be specified extremely close to required limits. Allowance for wear can be reduced considerably, automatically adding to manufacturing tolerances. Increased manufacturing tolerances can assure immeasurable gains in your production, and are especially important when parts being inspected are very close to required limits. They eliminate rejections of parts that should be accepted, which, in many cases, results in great savings both in expensive parts and man-hours.

Complete details are in the new Lincoln Park catalog. Write for your copy.

LINCOLN PARK TOOL and GAGE CO.
LINCOLN PARK, MICHIGAN

Send for Your Copies of These Helpful, Informative Bulletins on—

The Installation— Care— Adjustment of CENTURY MOTORS

Every user of electric motors should send at once for Century's new bulletins on the Installation — Care — Adjustment of Century Motors. Each contains full information on proper motor maintenance; how to check motor ailments and correct them; and how to keep your motors running at peak efficiency.

Under the pressing demands of War, Century Motors are working 'round the clock, often on continuous 24-hour, 3-shift production. Proper motor care is more essential these days than ever before, for equipment *must* be kept running for the duration.

These booklets are available for various types of Century Motors, Split Phase, Repulsion Start Induction, Capacitor, Squirrel Cage, and Direct Current Motors, both fractional and integral horsepower, Alternating and Direct Current Generators. You'll find valuable motor tips in every bulletin. Ask your nearest Century Motor Specialist for copies, or write direct to Century today.

One of the largest Exclusive Motor and Generator Manufacturers in the World. — Offices and Stock Points in Principal Cities.

Century MOTORS

294

CENTURY ELECTRIC COMPANY — 1806 Pine Street - St. Louis, Mo.

Please send me "Installation—Care—Adjustment" booklets on the following types of Century Motors:

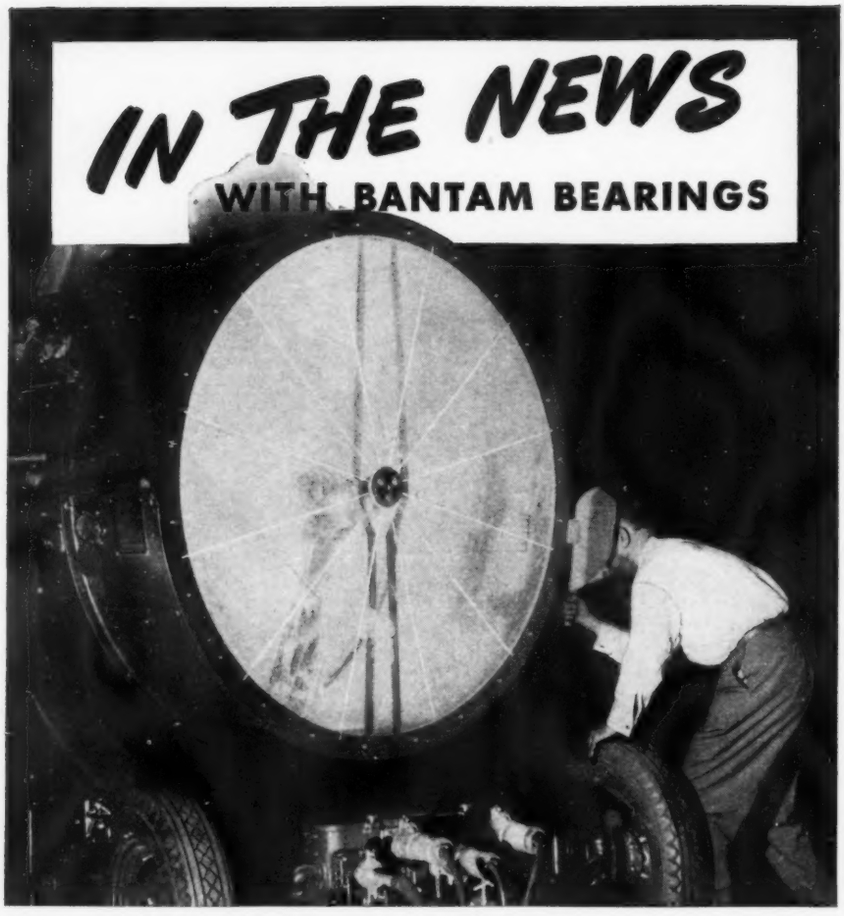
- ☐ Split Phase
- ☐ Repulsion Start Induction
- ☐ Capacitor
- ☐ Squirrel Cage
- ☐ Direct Current Motors
- ☐ Generators—Alternating Current
- ☐ Generators—Direct Current

Name.....

Company.....

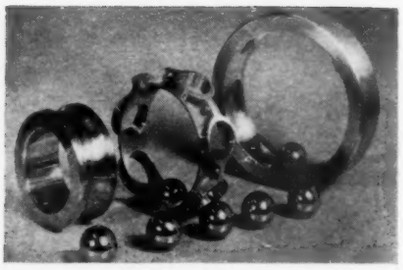
Address.....

City..... State.....

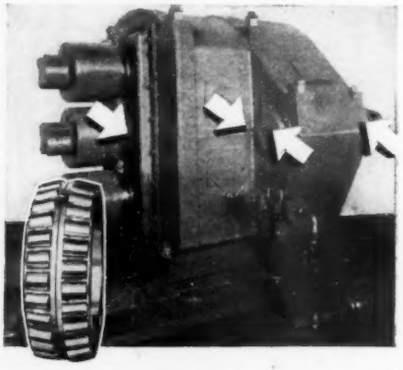


EYES OF THE ANTI-AIRCRAFT BATTALIONS, giant searchlights like this will pierce the skies with 800-million-candlepower beams to track down hostile planes. Among the advanced engineering features incorporated in the design of this searchlight is the use of Bantam Quill Bearings to assure high capacity, efficient operation, and long life at vital points in the trailer mechanism. Here is another instance of the many ways in which Bantam Bearings are contributing to the successful functioning of America's war equipment.

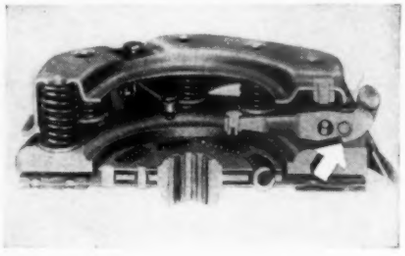
41,000 IN USE WITHOUT A SINGLE FAILURE is the remarkable service record established by Bantam Quill Bearings in the pumping units and pumping jacks built by the National Supply Co. Though subjected to the severe operating conditions of oil field service, the Quill Bearings have been performing with this consistent dependability for periods as long as five years. For further details on these compact, high-capacity, anti-friction bearings, write for Bulletin D-104.



ABILITY TO MEET SPECIAL REQUIREMENTS in bearing design is an important aspect of Bantam's service to industry. In addition to a comprehensive line of standard anti-friction bearings—straight roller, tapered roller, needle, and ball—Bantam offers a highly developed skill in the design and production of unusual types, such as this ball radial bearing. If you have a difficult bearing problem, TURN TO BANTAM.



SMOOTH, UNFAILING POWER for a three-high copper rod mill is transmitted by this special drive combined with a three-high pinion stand, built by Farrel-Birmingham Company, Inc. Bantam two-row tapered roller bearings are used both on the high-speed shaft of the gear reduction unit and on the center pinion of the three-high stand.

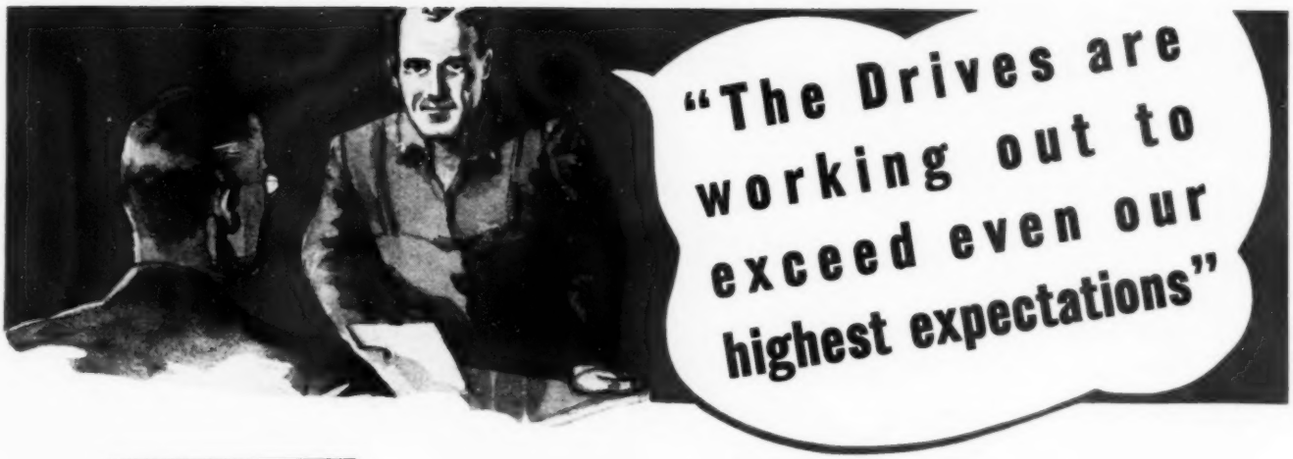


REDUCTION IN PEDAL PRESSURE is made possible through the use of Bantam Needle Rollers to form a compact, high-capacity anti-friction unit in the lever assembly of clutches produced by Long Manufacturing Division of Borg-Warner Corporation. Efficient lubrication throughout the life of the unit is an added advantage of these bearings.

BANTAM BEARINGS

STRAIGHT ROLLER • TAPERED ROLLER • NEEDLE • BALL

BANTAM BEARINGS CORPORATION • SOUTH BEND • INDIANA

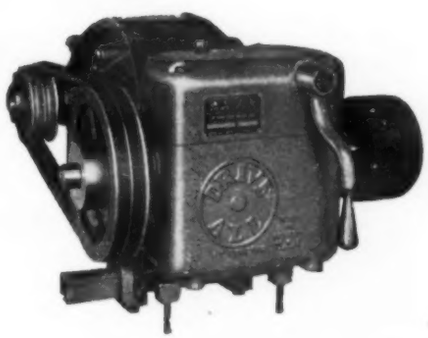


"The Drives are working out to exceed even our highest expectations"

"We have three Drive-All units in operation in our plant at the present time that were purchased for the conversion of some old equipment necessary for the urgent production of war materials. The Drives are working out to exceed even our highest expectations and we are extremely well pleased with the performance of our equipment and ease of operation."

MASTERFORM TOOL COMPANY
C. S. Zyskowski
General Manager

Standard Drive-All selective speed motorizing unit for universal application on belt-driven machines. 1 to 10 H.P. in either 3- or 4-speed models. Can be mounted for average machine in about two hours time. All models also available with clutch and with right or left hand output. Variety of standard mounting brackets save installation time.



☐ LATHES AND TURRET LATHES

☐ MILLING MACHINES

☐ GEAR CUTTERS

☐ DRILL PRESSES AND RADIALS

☐ AUTOMATICS

☐ SHAPERS AND PLANERS

☐ TAPPERS

☐ BORING MILLS

☐ SPECIAL APPLICATIONS

A card or letter will bring you a copy of the new Drive-All catalog. All inquiries given prompt attention.

DRIVE-ALL MANUFACTURING COMPANY

DETROIT, MICHIGAN

This Mark on Every Tang

MORE THAN 3000 SHAPES, CUTS AND SIZES
Cuts Nos. 00, 0, 1, 2, 3, 4, and 6

Hand	Slitting
Pillar (Regular)	Checkering
Pillar (Narrow)	Parallel Round
Pillar (Extra Narrow)	Coil or Point
Half Round	Half Round (Coarse Cut)
Slim Half Round	Flat (Coarse Cut)
Half Round Ring	Mill
Crossing	Mill (2 Round Edges)
Knife	Finishing
Warding	Taper Saw
Equaling	Slim Taper Saw
Barrette	Round Edge Joint
Cant	Square Edge Joint
Pippin	Die Sinkers
Crochet	Needle
Round	Escapement
Square	Machine
Three Square	Die Sinkers' Rifflers
Metal Saw	Silversmiths' Rifflers

Buy from Our Distributor

"Give us good tools and we will do the job" say the war workers in thousands of plants all over the country.

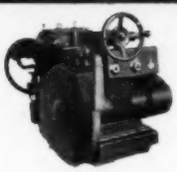
"American Swiss" Swiss-Pattern Files are the kind of precision tools they need for hand-finishing operations. These files assure accurate work . . . and long-continued use with maintenance of original keenness. These characteristics, which have distinguished "American-Swiss" files for over 40 years, explain their wide preference by tool and die makers and machinists.

AMERICAN SWISS FILE & TOOL CO. • ELIZABETH, NEW JERSEY

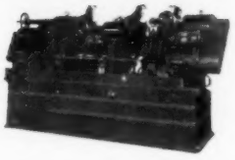
American Swiss SWISS-PATTERN FILES

FITCHBURG

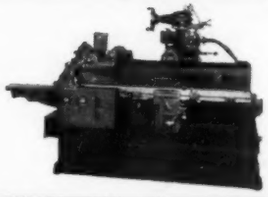
Save Money, Man-Hours and Spoilage



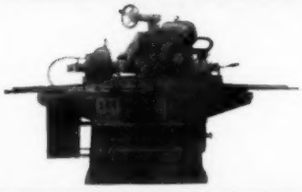
On High Speed Work: Bowgage Wheelhead units like this can be mounted on your present machines to increase production and accuracy control by a new application of accepted mechanical principles.



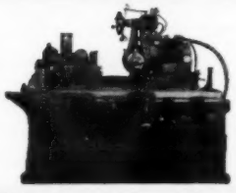
On Mass Production Work: Multiple precision grinding with special machines like these using standard Bowgage Wheelhead units.



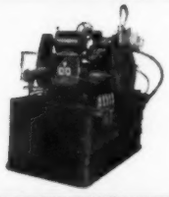
On Splines: Greater accuracy at higher speed saves on assembly time, evens torque pressures and produces finishes that wear better on sliding splines, to cut costs and boost profits.



On Plain Cylindrical Work: The Fitchburg Adjustable Angular Head Grinder has a standard Wheelhead Unit mounted so that it may be located to grind 0 degrees to 45 degrees angle. The Bowgage head on the "Type C" is adjustable and can be swiveled to various positions.



On Gear Grinding: The formed wheel method with an automatic closed cycle produces results in finish and accuracy with speed that will bring out hidden profits.



On Ojive Grinding: The special Bowgage Chucking Grinder with a heavy duty headstock, is designed for grinding the ojive of the 75MM armor piercing shell.

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U.S.A.

Manufacturers of — Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders and Bath Full Universal Grinders.

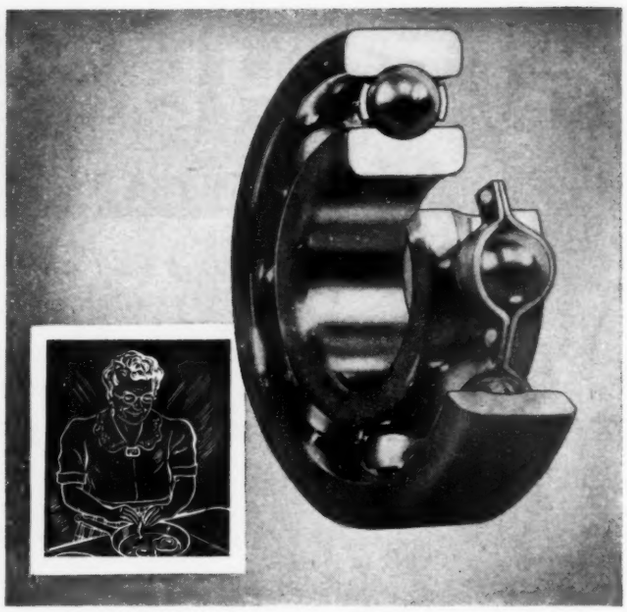
At all points of attack in mechanized war, mechanical strains and vibrational stresses reach new highs. At the same time, Allen Hollow Screws reach new highs of *resistance* to these stresses.

Your "Allens" HOLD. They are steeled to hold, threaded to hold, hardened to hold. They make fast your machine assemblies with a weld-like rigidity at the critical points.

Better hold *exclusively* to the hollow screws that for 32 years have been toughened to "take it" *NOW!*

Your local Allen Distributor will secure for you the largest shipments compatible with your priorities and our intensified production-effort.

THE ALLEN MFG. COMPANY
HARTFORD, CONNECTICUT, U. S. A.



A TIP FROM GRANDMA

On Mounting Ball Bearings!

EVER watch your grandmother fry an egg? Whether you realized it or not, she was giving you a tip or two on the proper mounting of ball bearings! Remember how thoroughly she cleaned her frying pan? How gently she handled the egg in carrying it to the stove . . . *taking care to avoid cracking the shell until the egg was directly over the pan?*

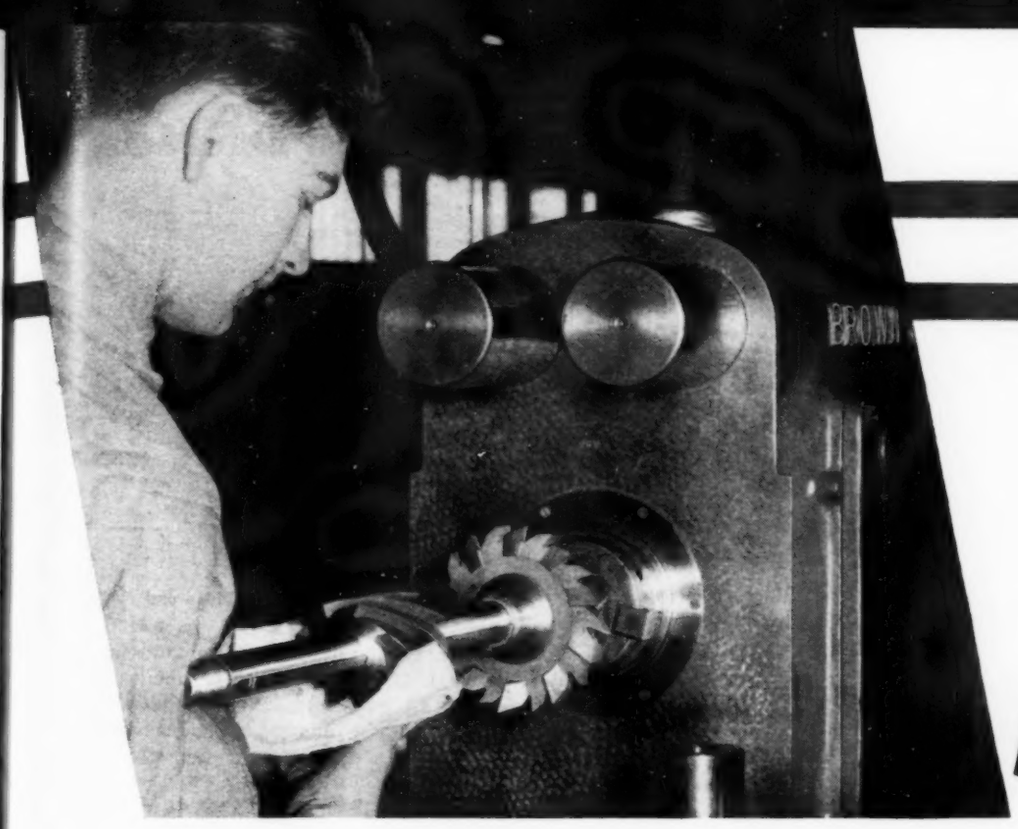
Well . . . one of the first precautions in mounting ball bearings is to clean the housing or shaft that is to receive the bearing as carefully as grandma cleaned the pan that was to receive the egg. Another important point is not to remove the protective wrapper *until you have carried the bearing to the shaft* . . . just as grandma carried the egg from the refrigerator to the frying pan before she cracked the shell.

Here's another tip. Consult page 8 of your BCA Data Book before mounting. Instructions given there will help you to grind the Axis . . . instead of your bearings!

BEARINGS COMPANY OF AMERICA, LANCASTER, PENNA.

Standardize on Standard Sizes

BCA **RADIAL • ANGULAR CONTACT • THRUST**
BALL BEARINGS



. . . GET MORE OUT OF YOUR CUTTERS

Cutters must do a greater day's work than ever before. Only a limited supply is available to serve the demands of increasing production.

You can help by using more care than usual with your cutters. By following the suggestions here to get the utmost production from the cutters you use, you can help to do your share in our united war effort.

✔CHECK THESE POINTS

Chatter is a serious cause of poor finish, and damage to cutters. Too much tooth clearance and lack of rigidity of the machine or cutter drive are contributing factors causing chatter.

Mount cutter as close as practicable to the spindle.

With small cutters (such as end mills) be sure to run at the same surface feet as required for larger cutters.

Handle cutters carefully. Prevent damage to the cutting edges.

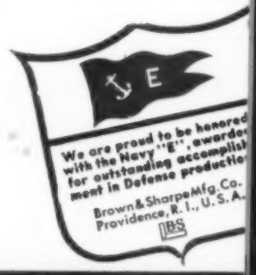
Watch cutters for wear. When dulling becomes excessive, too much metal is removed in the sharpening process. On a production job, sharpen the cutters after a predetermined number of cuts regardless of wear.

✔CHECK THE MACHINE Be sure machine is heavy enough to stand the cut — and in good condition • Use the *correct* spindle speeds with each setup • If coolant is needed, use enough.

✔CHECK THE ARBOR Use arbors of ample diameter • Insert shanks of arbors carefully in thoroughly-cleaned taper holes • Be sure ends of collars are not bruised • Provide adequate arbor support.

✔CHECK THE WORK Have the work clamped and supported properly • Work not rigidly held can cause premature cutter wear or even breakage.

Help the war effort—get the utmost in productivity and service from these critically needed cutting tools.


E
We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.
BS

Reprints of this advertisement for use on your bulletin board furnished on request.

BROWN & SHARPE CUTTERS

In war as in peace, production is speeded most when shipments travel by the sky route—AIR EXPRESS.

Essential war materials are given air transportation priority. For details phone Railway Express Agency, AIR EXPRESS DIVISION, or any airline.

NOW IN ITS 16th YEAR

AIR EXPRESS

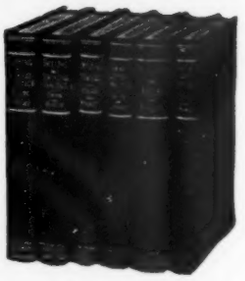
Division of RAILWAY EXPRESS

Increased Production

means more jobs for

MACHINISTS

—and MORE PAY for men who know their work



This big home-study and reference course gives you the practical facts on machines and methods you need to advance in machine shop work. Take advantage of the other man's experience as found in books, to solve your problems, increase your efficiency with

AMERICAN MACHINISTS' LIBRARY

6 volumes, 2516 pages, 2368 illustrations, many charts and tables

THESE books answer your questions on methods and machines—tell what you need to know about the operation of machines of all types and sizes for the whole range of metal cutting, forming, and finishing operations —show by text, diagram, and illustration the essential points of setting up work, adjusting machines, selecting feeds and speeds, determining pressures, handling materials, devising short-cuts, etc.

Puts the mastery of machine-shop work at your fingertips

With these books at hand for quick reference, no job is too hard or unusual, and the routine jobs may be improved, with savings in time and trouble and reduced wastage.

What the Library gives you

—complete guide for everybody, from shop executive to apprentices, interested in the operation of machines used in turning and boring practice

—description of all important varieties of machines, both manual and automatic, and methods of operating them

—data on speeds and feeds, new cutting alloys and materials, use of coolants, etc.

—practical information on grinding machines and abrasive wheels, showing what they do, how to operate them, and how to make best use of them on various types of work.

—training in the various operations performed in drilling and surfacing materials in the machine shop

—exact, descriptive data on all aspects of gear-cutting practice, useful in shops of any size

—essentials of selecting machines, setting up work, and handling operations in reaming, tapping, planing, shaping, slotting, milling, and broaching

No Money Down — Easy Payments

Let us send you these fact-packed books for 10 days' examination, with no obligation to buy the books unless you want them. Remember that, if you decide to keep the books the special library price represents a saving of $2.00 on the price of the books if you were to buy them separately. Furthermore, you may have the privilege of paying in small monthly installments, while you use the books. Invest in life's soundest commodity—KNOWLEDGE. Send the coupon today.

McGRAW-HILL ON-APPROVAL COUPON

McGraw-Hill Book Co., Inc., 330 W. 42nd St., N. Y. C.

Send me the American Machinists' Library, 6 volumes, charges prepaid, for 10 days' Examination. If I find the books satisfactory, I will send you $1.50 in 10 days, and $3.00 a month until the special price of $19.50 has been paid. Otherwise I will return the books postpaid. (To insure prompt shipment write plainly and fill in all lines.)

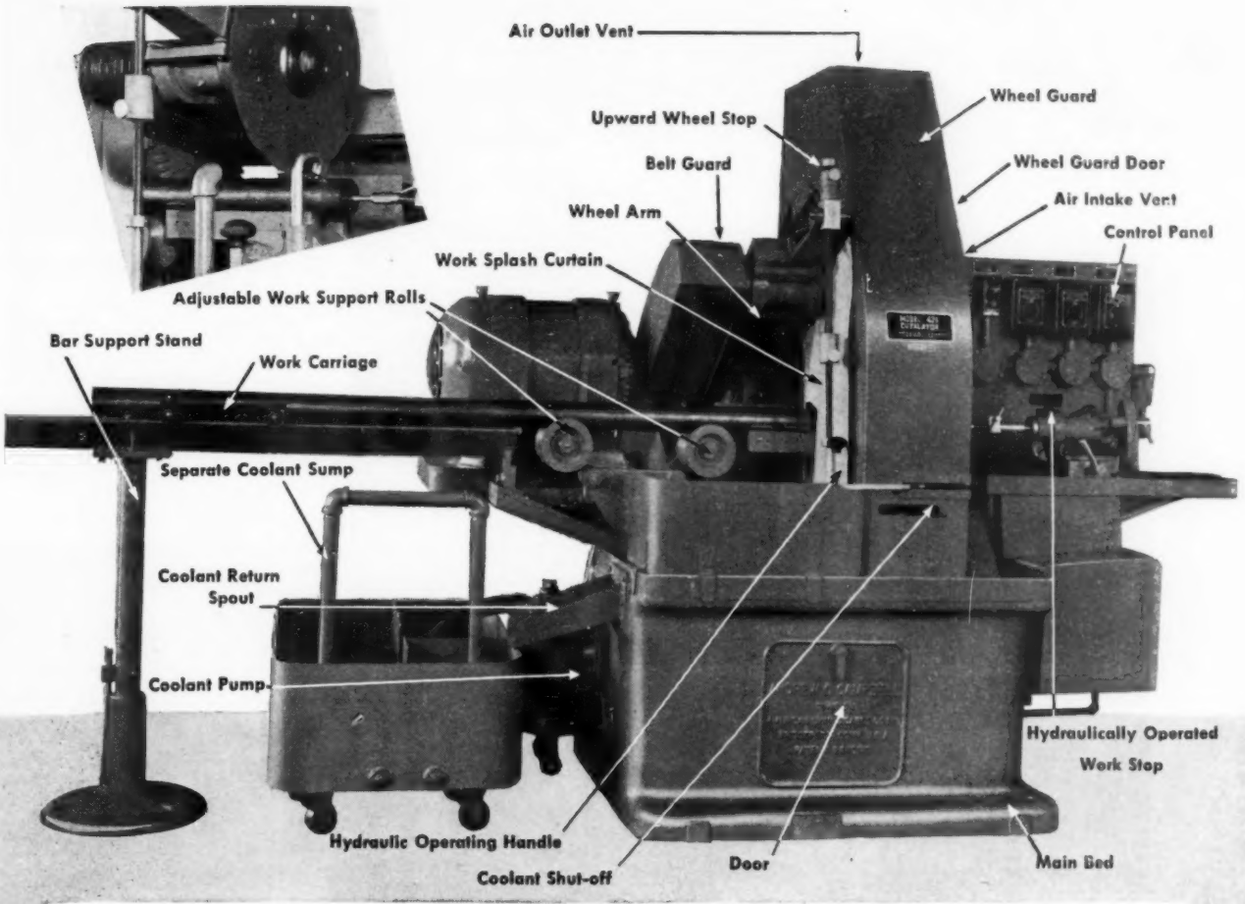
Name .....

Address .....

City and State .....

Position .....

Company .....A. 10-1-42



NEW! THE Campbell CUTALATOR

FOR ABRASIVE CUTTING OF TUBULAR SECTIONS TO 4½" DIAMETER . . . AND ANY SOLID STOCK TO 3½" DIAMETER—WITH TOP EFFICIENCY

You get accurate set-up because of new, hydraulic work stop. *Your production speed is increased by the controlled, rapid approach of the wheel to the work—and by the predetermined rate of cutting.* *Short arc of wheel contact, due to the oscillating-rotating motion of the wheel, gives you economical cuts.* *Accuracy and economy are added to by adjustable coolant wings.* *Finally, the new Campbell Cutalator is engineered to make certain that you get these advantages in your shop—the operations centering on the multiple positioned lever which hydraulically (a) positions stock automatically (b) clamps work and starts coolant flow (c) controls wheel approach and (d) starts predetermined-speed cutting.*

● The New **CAMPBELL CUTALATOR** is another example of how Campbell has engineered cutting machines to fit today's production—another reason for their current use on aircraft, aircraft engines, propellers; and for the production of trucks, cars, tanks, guns, bombs, shells, small arms ammunition, field telephones, etc.

● You will be under no obligation if you have a Campbell engineer study your cutting problems. Yet his suggestions may lead to important economies and increase in production.

A new booklet gives the interesting details of what you can expect of the new **CAMPBELL CUTALATOR**. Write for a copy.

ANDREW C. CAMPBELL DIVISION • Bridgeport, Connecticut

Campbell ABRASIVE CUTTING MACHINES

AMERICAN CHAIN & CABLE COMPANY, INC., BRIDGEPORT, CONNECTICUT

HALF of Last Year's Purchasers have ordered ADDITIONAL machines

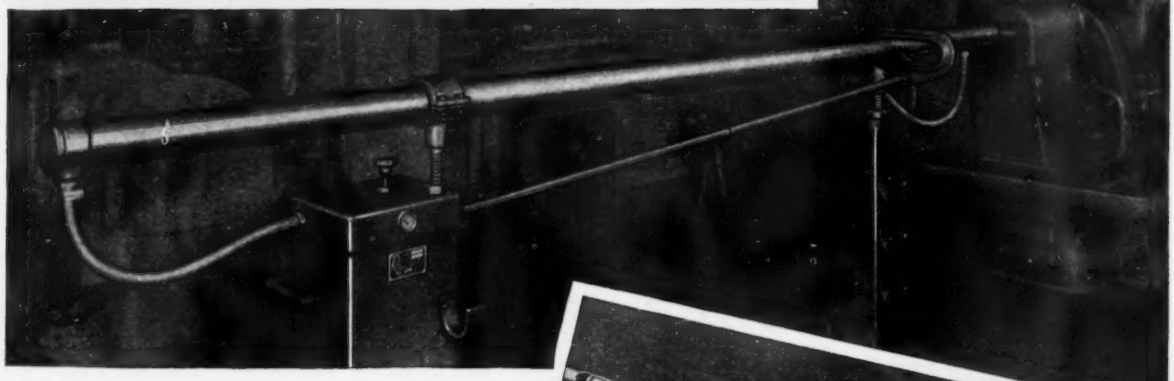
because the

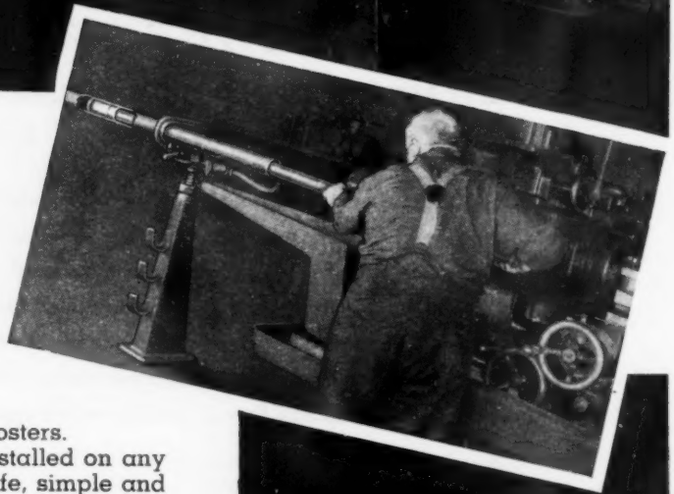
LIPE

PNEUMATIC BAR FEED

definitely increases screw machine output!

1. Feeds entire bar to last remnant.
2. Feeds accurately, rapidly, any distance.
3. Will not feed short.
4. Will not scratch or mar the stock.
5. Exact size polished stock can be used.
6. Saves from 15 to 20 minutes per 12 ft. bar.
7. Easily and quickly reloaded.
8. Shipped complete, ready to use. Just connect to shop air line.
9. Available for all manual screw machines up to 2½" capacity. Also for automatic screw machines No. 00, No. 0, No. 2 and No. 6.





TIME and again we've told you that this faster, easier and safer, Pneumatic Bar Feed would step-up your screw machine output. We said that screw machine operators in plants all over the country were claiming production increases ranging from 10% to 30%. But now here's word from the owners and plant managers. And they say it with RE-ORDERS—back opinions with money because Lipe Pneumatic Bar Feeds definitely prove their worth as production boosters.

The Lipe Pneumatic Bar Feed can be installed on any screw machine having a fixed stop. It's safe, simple and reliable. Automatically feeds an entire stock bar with but one setting. Stock is entirely enclosed. No whipping ends to catch clothing. No guards needed.

Bothersome feed parts—fingers, collars, ratchets, etc.—all are elminated. It's accident proof. Feed power cannot be applied until the cylinder is locked in working position.

● Investigate now. Don't let another day pass until you find out why other plants are ordering and re-ordering this valuable production aid. A nearby Lipe technical representative will call on request.

● The Lipe Pneumatic Bar Feed consists of an air cylinder long enough to enclose a full-length stock bar. A piston within the cylinder carries a ball-bearing cup center to support the free end of the stock bar. As the collet is opened, low-pressure air moves the piston, advancing the bar to the fixed stop. The action is fast and accurate.

LIPE-ROLLWAY CORPORATION · SYRACUSE, N. Y.

RIVETT

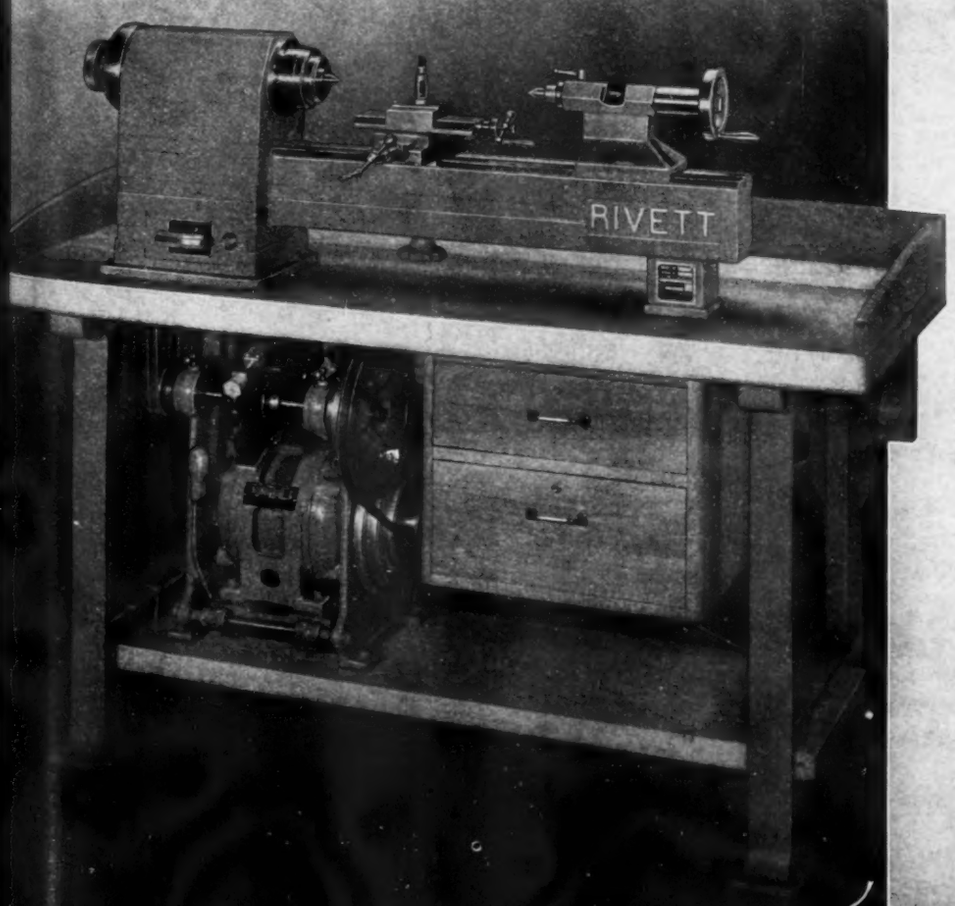
918 PLAIN BENCH LATHE

Revolutionizes Concept of Bench Lathe by Its Power and Vibrationless Performance

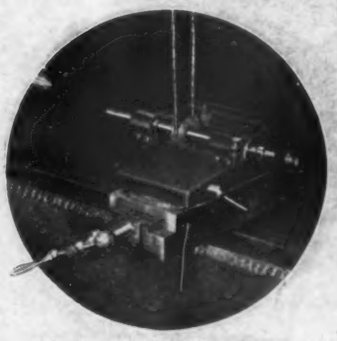
The Rivett No. 918 has been developed to advance the productive capacity of the plain precision bench lathe. Not only is it indispensable in the tool room and in light manufacturing, but it is capable of thousands of jobs often produced on heavy, costly machines. It has exceptional power, wide speed range, vibrationless performance; it is quickly set up, fast, accurate and trouble proof.

Operating convenience and long-life precision are well blended in the No. 918 design. Ball bearing spindle is mounted in rugged headstock enclosure supported by heavy box sectioned bed. Long taper key-drive spindle nose assures true running and positive drive for chucking attachments. Shoe mounting automatically squares compound slide rest with line of centers. Convenient control switch operates spindle drive. All driving vee belts are adjustable and may quickly be replaced without disturbing the lathe or drive assembly or removing the spindle from its bearings.

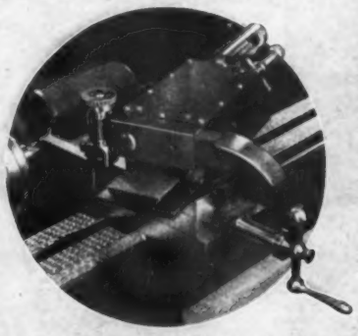
The No. 918 is furnished with bench or steel cabinet mounting and has a wide selection of attachments.



Slotting Attachment



Universal Grinding Attachment



Automatic Slide Rest

SPECIFICATIONS

Swing over bed, dia.	9"
Distance between centers	18"
Collet capacity, max. dia.	1"
Step chuck capacity, max. dia.	6"
Jaw chuck capacity, max. dia.	6"
Spindle capacity, max. dia.	1⅛"
Slide rest, travel of tool post slide	5¼"
Slide rest, travel of cross slide	5¼"
Tailstock spindle travel	3½"
Spindle speeds, eight forward and reverse	
Low range	150-2500 r.p.m.
High range	225-3750 r.p.m.
Weight of lathe, mounting and drive, net	850 lbs.

For Further Description Write for Bulletin 918

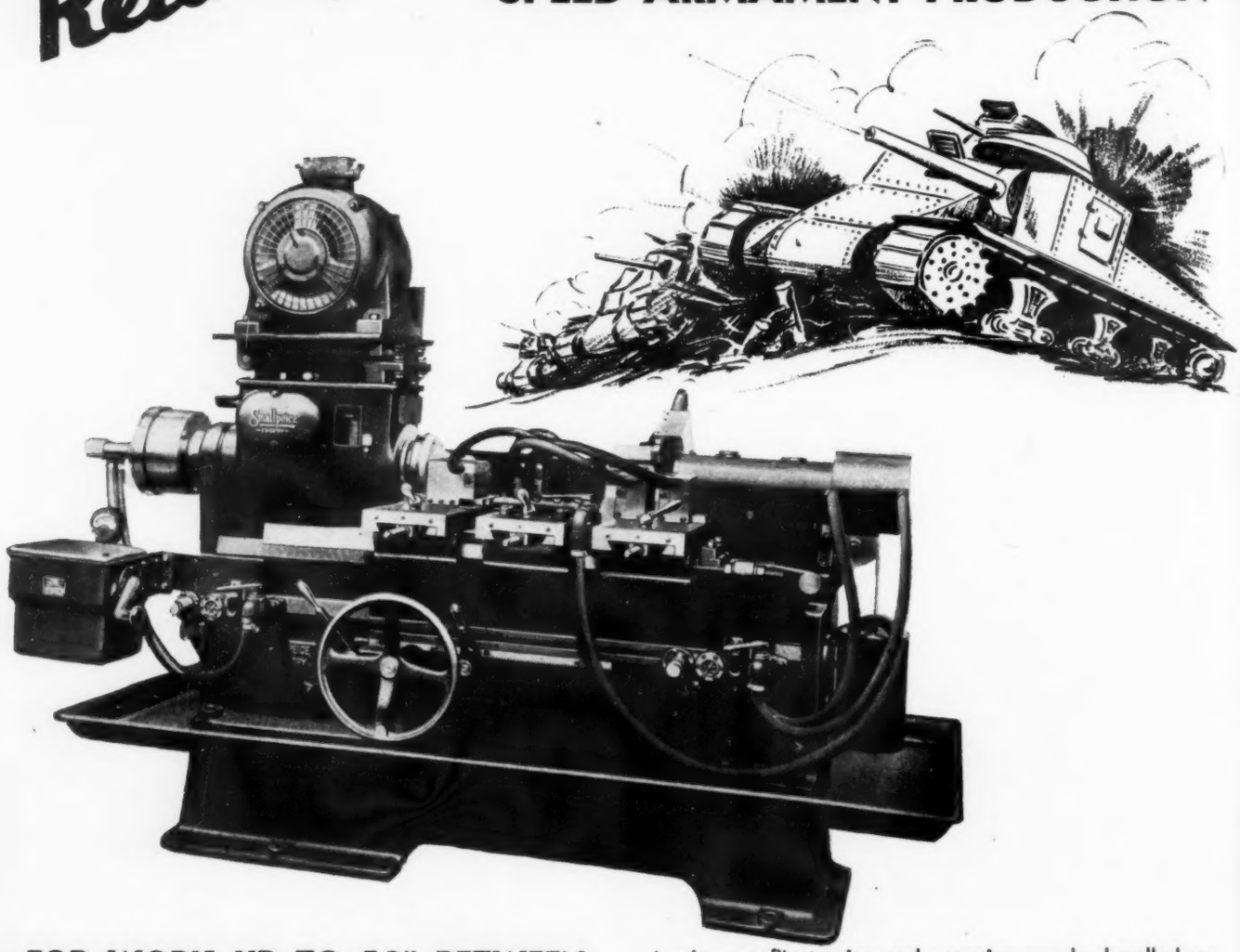
918 PLAIN BENCH LATHE

RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.
PIONEERS IN BENCH LATHE DEVELOPMENT

MULTI-TOOL

Reid-Smallpeice

PRODUCTION LATHES
SPEED ARMAMENT PRODUCTION



FOR WORK UP TO 58" BETWEEN CENTERS AND 18" SWING

These powerful, versatile machines are contributing to today's needs through fast and accurate production of parts for tanks and other implements of war.

REID-SMALLPEICE LATHES provide all operations for single purpose work with the facilities of all-purpose machines. Unit design provides for a wide range and variety of slides, over arms and similar attachments, which may be mounted in any combination on the single universal base. Rough and finish turning, facing, boring, grooving, forming, waving, taper turning, Veeing, shim turning, profile turning and grooving can be handled on these extremely versatile machines. Thus the REID-SMALLPEICE PRODUCTION LATHE offers the advantages of many machines in one, saving floor space, handling a wide variety of jobs and relieving production bottlenecks that would result from a shortage of machines otherwise necessary to do the same work.

SPECIFICATIONS

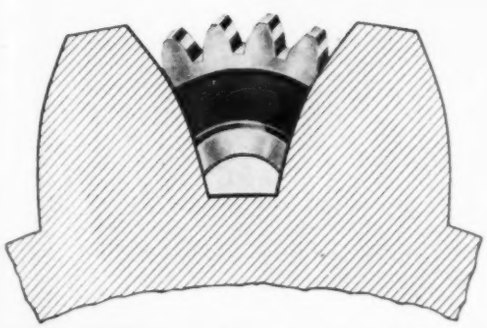
	6 W.S.L.	9 W.S.L.
Swing over bed	12"	18"
Between Centers	18"	22"
Between Centers (long bed)	30"/42"/54"	40"/58"
Spindle Speeds	10	8
Number of feeds	10	15
Floor Space	5'3"x3'0"	7'8"x4'0"

INVESTIGATE IMMEDIATELY—*Send for Illustrated Booklet*

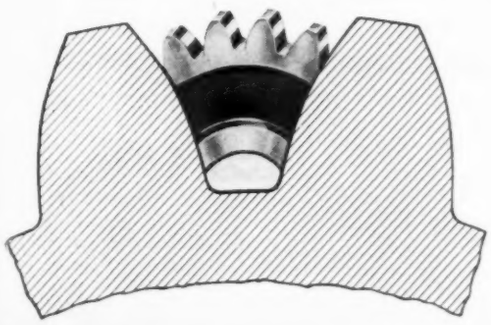
REID BROTHERS, INC. MANUFACTURERS IN UNITED STATES Beverly, Massachusetts

SMALLPEICE, LTD., Ellwood L. Houtz, Agent

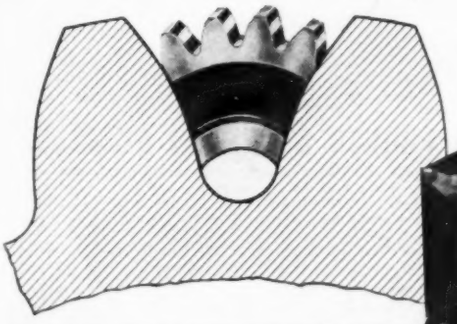
FORMED WHEEL GRINDING CONTROLLED ROOTS ...



STRAIGHT ROOT



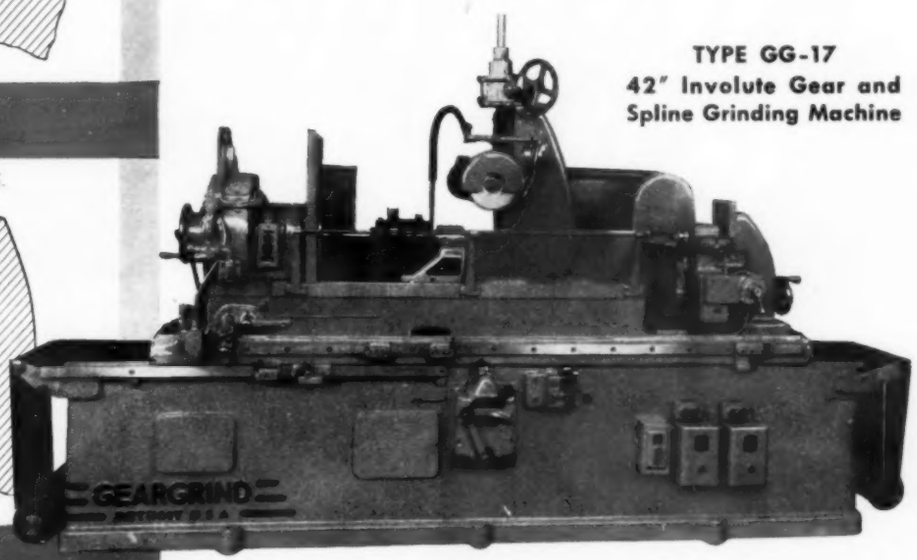
DEFINITE RADIUS FILLETS



FULL RADIUS ROOT

GEARGRIND Formed Wheel Grinders give you definite control of roots—just what your gear design calls for. Full radius roots and definite radius fillets that give absolute line continuity for carrying the greatest possible loads—or plain, straight roots—**GEARGRIND** handles them all.

For external and internal gears, external and internal involute splines, straight splines, serrations and racks, you can count on **GEARGRIND** for *absolute control,* constant production and the finest possible finish. Write today for full information.

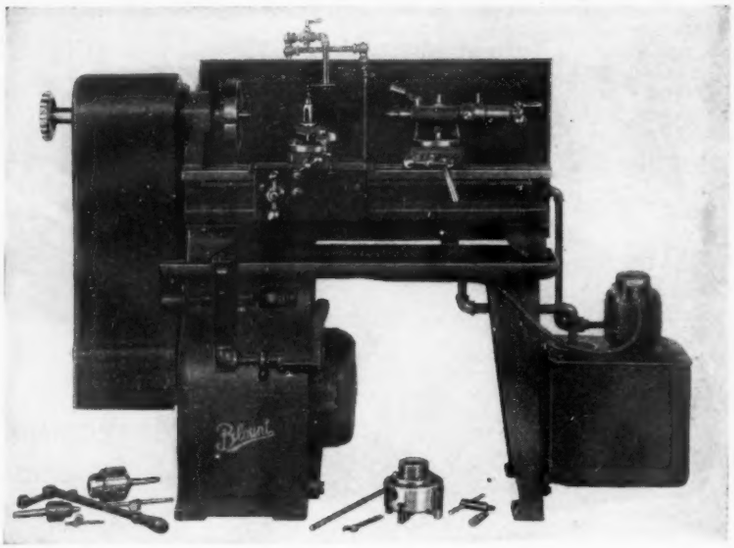


TYPE GG-17
42" Involute Gear and Spline Grinding Machine

The GEAR GRINDING MACHINE COMPANY
DETROIT, MICH. U.S.A.

"Blount" Model B-5 Special Purpose LATHE

Adaptable to handling many new types of work . . . . .



The Model B-5 Blount Special Purpose Lathe together with various attachments available for it, is capable of wide utility, including turning, chucking, polishing and lapping.

It is equipped with a ½ H.P., 4-speed ball bearing headstock motor-in-leg which provides speeds of 575, 850, 1125 and 1725 R.P.M. It has an 11" swing and a 4' bed. Other speeds, swings and bed lengths are also available. With adjustable bracket mounted motor, belted to head, spindle speeds of 360, 510, 680 and 975 R.P.M. are offered.

This lathe is equipped with drum controller, magnetic starter with pushbutton and disconnect switch. Spindle nose is 2⅜" dia. 10 v. threads. Spindle is fitted with hand wheel draw-in mechanism to accommodate Rivet No. 6 Collets, ⅛ to 1" capacities.

Equipment includes hand feed carriage and compound rest, full set-over-swivel tailstock V-belt drive and belt guard. Also coolant system complete including tank, strainer, pump, valves and piping.

Various accessories and attachments are also available.

Send for Bulletin D-18 which describes the various new Special Application Lathes developed by Blount.

J. G. BLOUNT COMPANY

Everett, Mass. U. S. A.

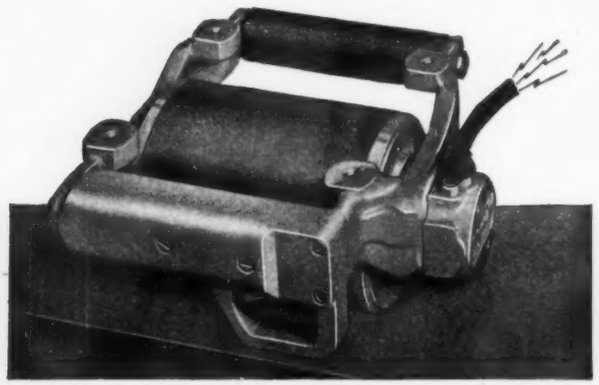
WALKER MAGNETIC CHUCKS

Style B Face Plate — in standard diameters from 10⅜" to 36½" inclusive.

No. 617 Bar P le Face Rectangular Magnetic Chuck.

DEMAGNETIZERS

Walker DEMAGNETIZERS are availab'e in standard D.C. and A.C. types for either 110 or 220 v. Ask for Bulletin K7 giving detailed specifications.



A FULL LINE OF PROVED STANDARD DESIGNS

Walker offers prompt and complete service on magnetic chucks by carrying in stock a considerable line of Rectangular and Rotary types for use on all surface and internal grinding machines built by American machine tool manufacturers. These units—for grinding, milling, planing and turning operations—are of proved design and are available in such a complete range of sizes as to enable you to select standard units for practically any chucking problem. Write for bulletin W4 giving detailed information.

Also special CHUCKS *for special* NEEDS

The design of Walker Magnetic Chucks is such that "specials" can be developed and furnished at prices only slightly more than standard units. If you require special magnetic chucks for special purposes, consult Walker and be assured of prompt, economical service.

O. S. WALKER CO., INC.

WORCESTER, MASS.

DISSTON CAN SUPPLY THESE METAL CUTTING BAND SAWS for immediate delivery

Improved production facilities make it possible for Disston to offer these high grade Metal Cutting Band Saws. The fine steel and quality craftsmanship of Disston Band Saws will help you in problems of cut-off work in ferrous and non-ferrous metals—cutting die stock—cutting dies to shape—cutting gates and risers from castings—production cutting.

AVAILABLE NOW!

Disston Hard Edge Flexible Back Metal Band Saws in which the blades are hardened on the tooth edge only are used for operating at low speeds. Teeth are not punched but *milled*—and then set accurately by machine. Two types of set: *Raker Set*, in all numbers of teeth except 32 per inch—for general metal cutting and especially steel, cast iron and tougher alloys. *Group Set*, in 32 teeth per inch only, for thin wall tubing, mouldings and similar shapes.

AVAILABLE NOW!

Disston Hardened Throughout Metal Cutting Band Saws are supplied with either Regular or Pullman type teeth. Made for operating at high peripheral speeds and used for cutting thin sheet metal, non-ferrous alloys, bakelite, micarta and other similar materials.

Ask your distributor for complete information or write today to Henry Disston & Sons, Inc., 1020 Tacony, Philadelphia, Pa., U. S. A.

THE DISSTON CONSERVATION CONTROL PLAN, a nationwide program to save essential tools and materials for greater war production, is now being applied with outstanding success by thousands of plants. Send today for the booklet describing the Plan and containing reproductions of Instruction Cards for workmen, covering 34 different types of cutting tools. The cards are supplied on request, without charge.

CONSERVATION SERVES EVERYONE

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

GET YOUR SCRAP INTO THE SCRAP!

PROVED ON AIRCRAFT

... and now used in every industry

1927 saw the first application of Elastic Stop Nuts on airplanes. When it was proved that these self-locking fastenings hold tight under any combination of vibration, shock, stress, and weather exposure, they were adopted for vital connections on all American military and transport aircraft.

Meanwhile other industries, profiting by such a convincing demonstration in the air, solved many of their most troublesome fastening difficulties with the same reliable nuts.

Today there are more Elastic Stop Nuts on America's airplanes, tanks, guns, Naval vessels, and production equipment, than all other lock nuts combined.

●

ELASTIC STOP NUTS may be the solution to *your* fastening problems. Sample nuts, for laboratory or field testing, will be furnished without cost or obligation.

» Write for interesting folder explaining the Elastic Stop self-locking principle.

... And see the Elastic Stop Nut Exhibit at the National Metal Exposition.

ELASTIC STOP NUT CORPORATION
2351 VAUXHALL ROAD • UNION, NEW JERSEY

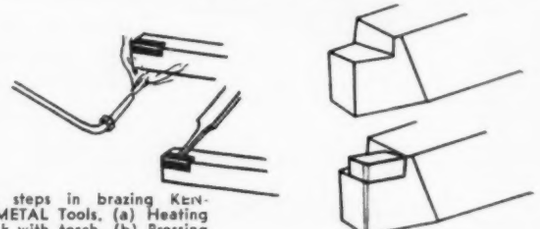
WITH THE RED LOCKING COLLAR ... SYMBOL OF SECURITY

Delivery of materials has jumped from a last place problem before the war to eighth in importance in our national production system.

Reclaim that backlog of old tool shanks accumulated through the years, and at the same time save weeks on tool delivery schedules.

Here's *HOW* TO DO IT—

1. Cut off tool shank back of old tip.
2. Mill recess or step in shank end to accommodate KENNAMETAL tip; the sidewall on the recess is not necessary and eliminating it avoids brazing strain caused by warping.
3. Heat tool shank and "tin" recess with Tobin Bronze.
4. After tip is rough ground or sandblasted, drop tip into place and cover with flux.
5. Apply brazing alloy along meeting edges of tip and recess wall.
6. Hold down with rod or tong of file until "set."
7. Machine tool to proper clearances for your particular job.



Two steps in brazing KENNAMETAL Tools. (a) Heating shank with torch. (b) Pressing tip into place with file.

For complete information concerning KENNAMETAL tips and tools, write for the Vest Pocket Manual

* INVENTED AND MANUFACTURED IN U. S. A.

McKENNA METALS Co.
103 LLOYD AVE., LATROBE, PENNA.
Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York
Exclusive of Canada and Great Britain

TRADE MARK REG. U. S. PAT. OFF.

DEFIANCE

Today's "battle of production" finds Defiance Mills in the "front line" of action in many of the nation's war plants... where speed, accuracy and rugged simplicity of design are essential.

Shown here are several of a large battery of Defiance Mills in one of our country's great war arsenals. These Horizontal Boring Mills meet the demand for a high speed precision machine that adapts itself for use in plants where general horizontal boring mill work is required... in tool rooms or in tool and die shops for the manufacture of tools and dies of large proportions.

Defiance engineering takes great pride in solving tough machinery problems. As a result Defiance performance is widely recognized among shop men as "tops" in precision, ruggedness and dependability. See our insert in Sweet's Mechanical Catalog or write for latest bulletins.

Defiance Machine Works, Inc.,
Defiance, Ohio.

Makers of Precision Machinery Since 1850

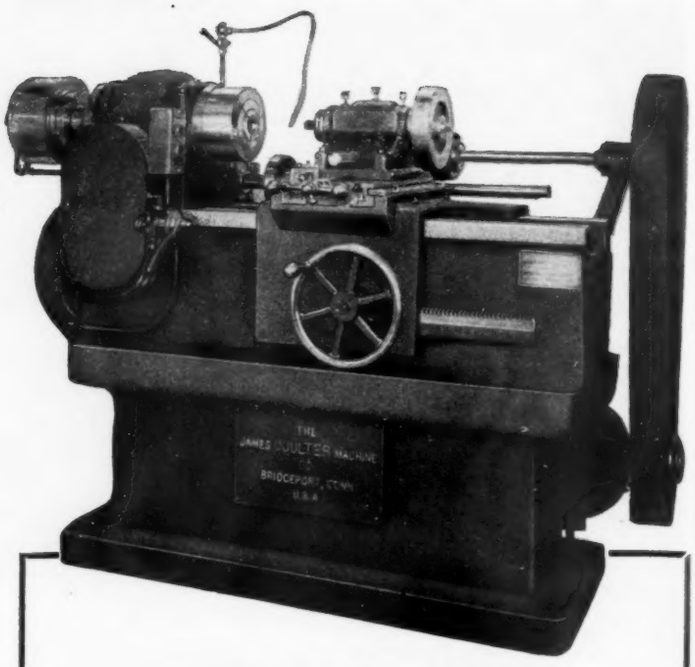
Horizontal **BORING..MILLING..DRILLING..TAPPING** *Machines*

Keep Ahead of
DEFENSE DEMANDS
on the PRODUCTION of
EXTERNAL and INTERNAL THREADS

The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

Maximum external thread, 7"; minimum hole depends on smallest hob practical.



Send for Descriptive Bulletin giving full information.

The James COULTER *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.

WILLARD *Spring* TOOL HOLDERS

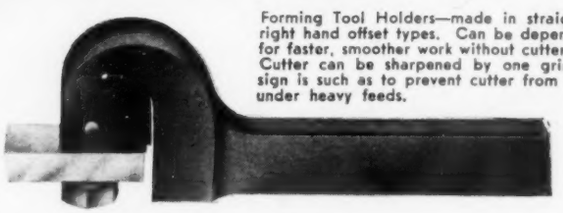
SAVE TIME • PROTECT WORK • INCREASE CUTTER LIFE

These modern tool holders—especially adapted for use in precision production—can be depended on to prevent chatter and protect against broken cutters and damaged work.

Willard Tool Holders offer a spring feature which makes it safely possible to step up feeds and make heavier cuts, thereby saving valuable time on important war production work.

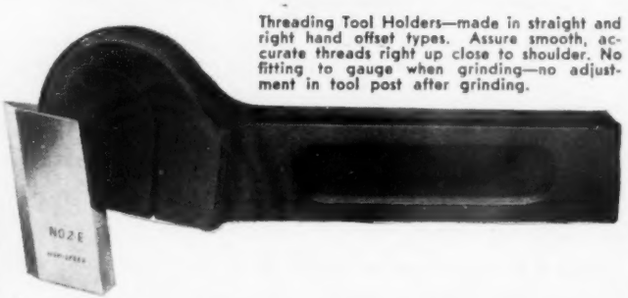
•

WILLARDS ARE AVAILABLE FOR FORMING TOOLS, CUTTING-OFF TOOLS THREADING AND FORMING TOOLS, AND THREADING TOOLS—



Forming Tool Holders—made in straight and right hand offset types. Can be depended on for faster, smoother work without cutter marks. Cutter can be sharpened by one grind. Design is such as to prevent cutter from turning under heavy feeds.

Threading and Forming Tool Holders—a universal holder for use on fine or coarse threading. Eliminate possibility of chatter or tool marks—assure uniform high quality work and more pieces per grind when used for holding forming tools.



Threading Tool Holders—made in straight and right hand offset types. Assure smooth, accurate threads right up close to shoulder. No fitting to gauge when grinding—no adjustment in tool post after grinding.

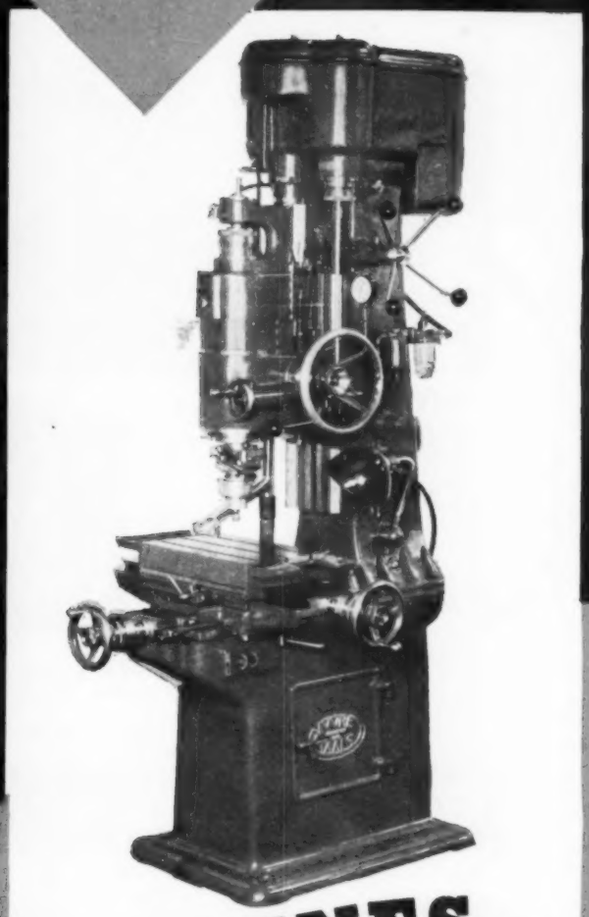
PROMPT SHIPMENTS ASSURED *Write today for Folder giving details of sizes and types.*

Product of AUTO-ORDNANCE CORPORATION

TRADE MARK Thompson REG. U.S. PAT. OFF.

1437 Railroad Ave., BRIDGEPORT, CONN.

MOORE JIG BORER



MOORE JIG GRINDER

COMPANION MACHINES..

contributing to the maximum in speed and precision on armament tool and die work . . .

Spotting, drilling, reaming and boring — at big time savings—on the MOORE JIG BORER

Advanced in design and proved in use, this machine will produce more holes to closer accuracy limits in less time.

Spindle supported on four pre-loaded ball bearings; ten spindle speeds from 100 to 2600 R.P.M.; table working surface 10"x16"; table top to spindle end—3" min., 16" max.; boring capacity (with two speed motor) 3½" tool steel, 4" soft steel.

Relocating and grinding holes — faster and more accurately — on the MOORE JIG GRINDER

This machine—a companion to the Jig Borer—meets every requirement for time savings and utmost accuracy in grinding straight or tapered holes to size and location in hardened steel parts.

With a grinding capacity from .030" to 4", accuracy of screws of .00005" per inch and grinding speeds of 15,000, 25,000 and 45,000 R.P.M., the Moore Jig Grinder is ideally suited to operations on dies, drill jigs, master plates and precision gage parts.

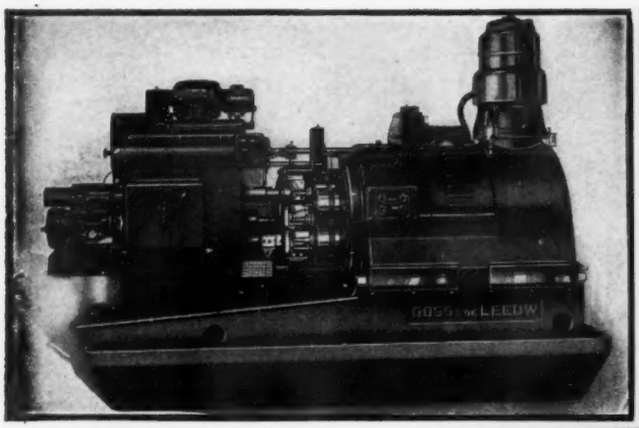
BULLETINS giving complete details on these two indispensable companion machines are available promptly on request. Write today.

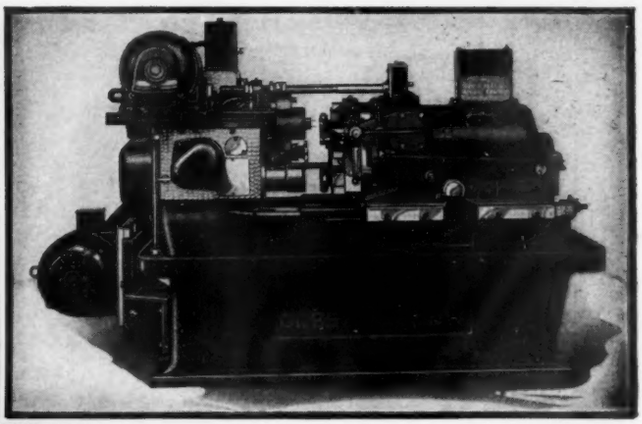
Manufactured by

THE MOORE SPECIAL TOOL CO., INC.

BRIDGEPORT, CONNECTICUT

Exclusive Sales Representative: MARBURG BROTHERS, Inc., 90 West Street, New York City





WORK ROTATING TYPE

5 Spindles
6 Spindles
8 Spindles

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES

TOOL ROTATING TYPE

4 Spindles
5 Chucking Positions

On these machines, two threading operations can be handled simultaneously, each thread controlled by its own lead screw.

Among the many other modern features offered in both types are: pre-loaded anti-friction spindle bearings, hardened ways, oversize spindles and gears of chrome-nickel steel, heat-treated.

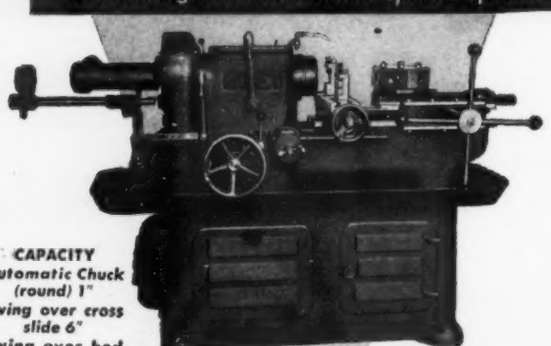
Complete details will be found in descriptive catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

---

for ECONOMY—*for* HIGH SPEED PRODUCTION

The MOREY 2G
Back-Geared
TURRET LATHE
Timken Bearing
Self-Locking Turret and Infinite Spindle Speeds



CAPACITY
Automatic Chuck (round) 1"
Swing over cross slide 6"
Swing over bed 14"

Thousands of the MOREY 2G Turret Lathes are saving money with no sacrifice of high speed production. Economy features: Back Gears are instantly thrown in through extra large Twin Disc Clutch—Full advantage from high speed and carbide tools—Vibrationless precision and an infinite variety of spindle speeds for every job—Timken bearing—Self-locking turret. Can be furnished with tooling.

Ask for Circular 629 for full details

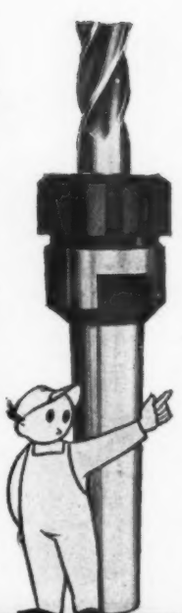
MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

UNIVERSAL FIRST COMPANY IN AMERICA TO WIN COVETED 20% BOND FLAG

When each of the 550 of us here at Universal helped give the Allied cause a boost by being America's first industrial plant to subscribe 20% for War Bonds we were mighty proud.

But we're even more proud of the big volume of precision built collet chucks we're turning out daily to help America's arms production.

The Universal collet chuck shown here has ground threads, ample room for tool feed out and is ideal for holding end mills, keyway cutters, drills, etc. Write for facts.



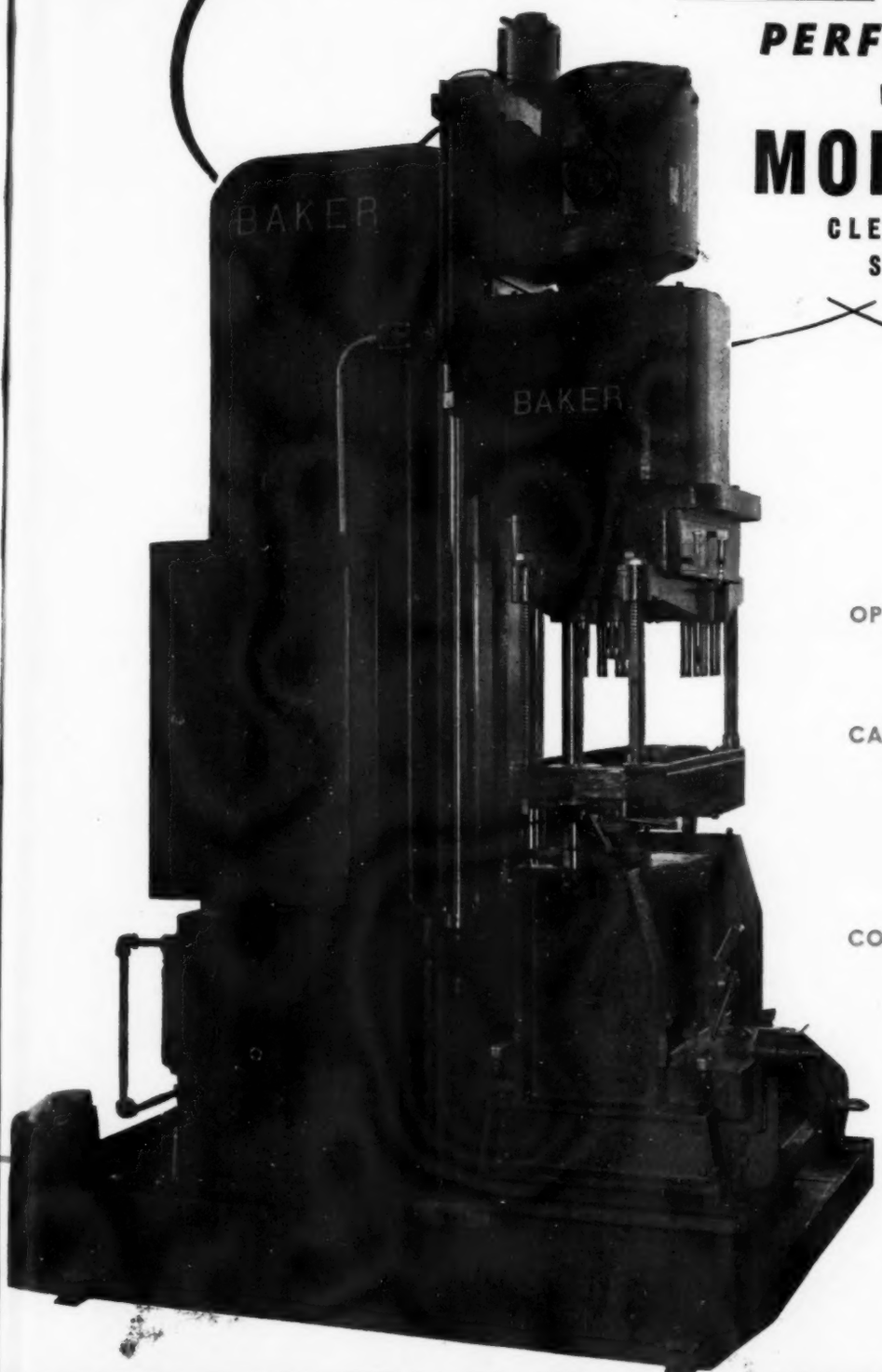
UNIVERSAL ENGINEERING CO.
FRANKENMUTH • MICHIGAN

BAKER

. . . PROVIDES SPEEDY, VERSATILE PERFORMANCE WITH THE

MODEL 26-HO

CLEANLINE HEAVY-DUTY SINGLE and MULTIPLE SPINDLE DRILL!



This Model 26-HO Cleanline clearly demonstrates the advantages of the application of a basic standard unit, properly tooled-up to produce more for less. Check the operational, capacity and construction data below . . . then figure how one or more of these BAKERS on your production line can help you solve your current problems. Write for new circular, giving complete data!

OPERATION:

The MODEL 26-HO handles heavy-duty single and multiple spindle operations. There are two machines in this model . . . suited to drilling, boring, counterboring, facing, forming and recessing operations.

CAPACITY:

The 26-HO has a maximum capacity of 3" dia. drill in solid S.A.E. 1035 steel, and takes up to a 15 H.P. motor for drive to head. Standard, the 26 HO has two cylinders of 3¾" bore, giving a feed pressure of 18,500 lbs. and a rapid traverse of 195" per minute. At no extra cost, special 3¼" bore cylinders can be provided . . . feed pressure is reduced to 14,600 lbs., but rapid traverse speed is increased to 275" per minute.

CONSTRUCTION:

Streamlined, with all major units enclosed—to provide safety and greater cleanliness. GEAR BOX mounted direct on feeding saddle, with PICK-OFF GEAR provision. HYDRAULIC FEED, saddle type, with Baker patented Twin Pull feed cylinder mounting. MAIN SPINDLE SPEEDS and DRIVE from motor mounted above head—a wide range of speeds available. LUBRICATION is automatic. TABLES either box type of plain—special to meet your needs. CUTTING COMPOUND attachments with pumps can be furnished.

Here's a Model 26-HO Cleanline unit tooled up with a multiple spindle head and special cross index fixture for multiple operations in oil sump as used on radial aircraft engines. The machine handles drilling, reaming and counterboring operations in this magnesium casting.

BAKER BROTHERS INC. Toledo, Ohio, U.S.A.

OUR MOTTO SINCE 1867
"MACHINES: STURDY and EFFICIENT, AS FINE AS CAN BE BUILT . . ."

DRILLING • BORING • TAPPING AND KEYSEATING MACHINES

Better Results

in less working time with

WELDON ROBERTS

Brightboy

REG. U.S. PAT. OFF.

"The Soft Rubber Binder Cushions the Abrasive"

CLEANING • POLISHING

Tools, taps, dies, flush sets, drills, parts, in aluminum alloy, steel or brass

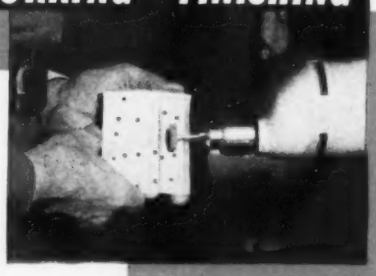
In countless instances Brightboy—a revelation in abrasives—is contributing time savings to war industries. Work on planes, tanks, engines, guns and parts is being handled in a fraction of the time.

Brightboy's action is unique—unlike a grind or a buff. A Brightboy wheel will de-burr, polish and put on a slight radius all in one operation. A Brightboy tablet, stick or special shape has innumerable applications for manual work or on a machine bed or a press. Brightboy is particularly effective in close tolerance operations.

Brightboy is available to war industries through recognized mill supply distributors. Brightboy's field men are at your service. Write us *today* for catalogs and prices if your regular dealer cannot supply you.

DE-BURRING • FINISHING

BRIGHTBOY INDUSTRIAL DIVISION
WELDON ROBERTS RUBBER CO., Newark, N. J., U. S. A.



Holes and edges in alclad part

1. **No "Time Out" changes in methods—**
   Brightboy is used in the conventional manner
2. **No special training necessary—**
3. **No special preparation—**
   Ready for *immediate* use
4. **No waste—**
   Every bit is usable

Removes Light Digs, Tool and Heat Marks Cleans Welded and Soldered Joints Finishes Dies, De-burrs Light Stampings and Machined Parts

FREE INFORMATION FOR YOUR METAL-WORKING LIBRARY

New Catalogs, Booklets, Bulletins

METAL-WORKING EQUIPMENT

1 MILLING MACHINE PRACTICE—Cincinnati Milling Machine Co., Cincinnati, O. 28-page illustrated booklet, analyzes milling processes with diagrams and technical data. Gives information on milling cutters and uses with tables of dimensions. Describes milling machines and attachments.

2 BORING AND TURNING MILLS—Cincinnati Planer Co., Cincinnati, O. 24-page illustrated bulletin 175 on vertical boring and turning mills, gives details and specifications of machines, parts, and attachments.

3 GRINDERS—Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn. 16-page catalog illustrates face grinders, knife grinders, grinding wheels, cut-off machines, floor grinders, buffing lathes and tool grinders with specifications and details.

4 WET TOOL GRINDERS—J. G. Blount Co., Everett, Mass. Illustrated folder describes 20-in. special wet tool grinder for tungsten carbide tools with description of construction, dimensions and specifications.

5 PRESS BRAKES—Cincinnati Shaper Co., Cincinnati, Ohio. 64-page illustrated catalog gives comprehensive details on up-to-date applications and developments of modern press brakes. Complete with engineering tables.

6 LATHES—Lodge & Shipley Machine Tool Co., Cincinnati, O. 28-page illustrated catalog on No. 3A duomatic lathe, describes purpose, features, and cycles with setting up diagrams showing operations in detail. Instructions and specifications, with views of machine from all angles.

7 HONING MACHINES—Micromatic Hone Corp., Detroit, Mich. 8-page illustrated catalog AR-67 describes honing machines, fixtures, tools, and abrasives. Gives advantages.

8 MILLING MACHINES—Jefferson Machine Tool Co., Cincinnati, O. 8-page illustrated folder on precision milling machines, conversion attachments for lathes, endless belt sanding machines, swing frame grinding and polishing machines, etc. Prices, details and specifications.

9 LATHES—South Bend Lathe Works, South Bend, Ind. 8-page illustrated catalog 16, describes 16-in. series of precision lathes with details of parts and specifications.

10 MACHINE TOOLS—Ex-Cell-O Corp., Detroit, Mich. 20-page, wire-bound bulletin 27121, illustrates with specifications and details entire line of products, including thread grinders, boring, turning and facing machines, universal fixtures, carbide tools grinders, lapping machines, grinding spindles, cutting tools, etc.

11 MACHINE TOOL LUBRICATION—Cincinnati Millers and Grinders, Inc., Cincinnati, O. 56-page catalog diagrams with details lubrication of Cincinnati milling, grinding, broaching, and lapping machines. Invaluable to users.

12 CYLINDRICAL GRINDERS—Norton Co., Worcester, Mass. Full-color folder has large illustrations with specifications of cylindrical grinders for plunge cut and traverse jobs in same machine.

13 INDUSTRIAL SUB-ZERO MACHINES—Kold-Hold Mfg. Co., Lansing, Mich. 8-page illustrated folder describes industrial sub-zero machines for maintaining predetermined temperatures as low as —90 deg. F. For use in optical lens processing, welding tip refrigeration, aircraft rivet storage, expansion fits, and aging of steel to prevent growth.

For Your Convenience

Two business-reply cards are printed here. On each is room for you to request four pieces of literature.

How to Order

1. If you are requesting four pieces or less, please use only the bottom card. Likewise, for five to eight pieces, use both cards.

2. Be sure to fill one space for each piece you order. This will assure your receiving copies of literature promptly by reducing clerical work in handling your requests.

3. When you have filled out one space for each catalog or bulletin you want, detach along the scored lines and drop the cards in the mail. No postage is required.

Example

Write in circle number of item describing one catalog wanted → (23)

Name Eugene H. Roderick

Company W.C. Dow Mfg. Co.

Company ☐ or Home ☒ Address 1243 E. 7th St.

Brooklyn New York Title Supt.

AMERICAN MACHINIST, New York. 10-1

These cards not good after December 1, 1942

Write in circle number of item describing one catalog wanted →

Name.....

Company.....

Company ☐ or Home ☐ Address.....

..... Title.....

AMERICAN MACHINIST, New York. 10-1

Write in circle number of item describing one catalog wanted →

Name.....

Company.....

Company ☐ or Home ☐ Address.....

..... Title.....

AMERICAN MACHINIST, New York. 10-1

Write in circle number of item describing one catalog wanted →

Name.....

Company.....

Company ☐ or Home ☐ Address.....

..... Title.....

AMERICAN MACHINIST, New York. 10-1

Write in circle number of item describing one catalog wanted →

Name.....

Company.....

Company ☐ or Home ☐ Address.....

..... Title.....

AMERICAN MACHINIST, New York. 10-1

Write in circle number of item describing one catalog wanted →

Name.....

Company.....

Company ☐ or Home ☐ Address.....

..... Title.....

AMERICAN MACHINIST, New York. 10-1

Write in circle number of item describing one catalog wanted →

Name.....

Company.....

Company ☐ or Home ☐ Address.....

..... Title.....

AMERICAN MACHINIST, New York. 10-1

Write in circle number of item describing one catalog wanted →

Name.....

Company.....

Company ☐ or Home ☐ Address.....

..... Title.....

AMERICAN MACHINIST, New York. 10-1

TOOLS AND ACCESSORIES

14 CARBIDE TOOLS — Firth-Sterling Steel Co., McKeesport, Pa. 38-page illustrated catalog describes Firthite standard and special purpose tools with selection guide and diagrams of non-standard tip shapes and tool design. Also 44-page illustrated catalog with new prices on standard tools, general-purpose tools and standard tips. Good reference.

15 METAL DUPLICATING—O'Neil-Irwin Manufacturing Co., Minneapolis, Minn. 32-page illustrated catalog, describes Di-Acro system of metal duplicating without dies. Illustrates with specifications, equipment and typical parts made with them. Outlines advantages, particularly when small quantity desired.

16 GRINDING WHEELS—Waltham Grinding Wheel Co., Waltham, Mass. 4-page folder describes construction of line of grinding wheels and available types.

17 RUST PROOFING—Nox-Rust Corp., Chicago, Ill. Wall chart gives U. S. government specifications on rust preventives for various applications and shows how various Nox-Rust compounds take care of them.

18 VIBRATION MEASUREMENTS — Televiso Products, Inc., Chicago, Ill. 4-page folder describes design and application of Vibrometer for electronic measurement of vibration for eliminating damage or loss due to vibration in design and production of armaments and essential civilian goods.

19 AIR TOOLS—Rotor Tool Co., Cleveland, Ohio. 12-page illustrated catalog shows how to make air tools last longer. Many helpful hints shown through cartoons.

20 DIE SETS—Leslie Welding Co., Chicago, Ill. Illustrated folder describes self-balancing, positive alignment universal die sets for press brakes of all sizes. Gives advantages and range of applications with diagrams to illustrate points.

21 MOUNTED WHEELS—Chicago Wheel & Mfg. Co., Chicago, Ill. Illustrated, informative booklet shows all types of mounted wheels and accessories for use with high-speed portable equipment. Includes selection guides with details on newly developed mounted polishing wheels.

22 VISES—Studebaker Machine Co., Chicago, Ill. 4-page illustrated folder on hydraulic drill vise for speeding work on drill presses, milling machines, surface grinders, shapers, boring machines, etc. Gives specifications, advantages and details.

23 TOOLS—American Swiss File & Tool Co., Elizabeth, N. J. 12-page illustrated catalog describes and lists more than 500 different types and sizes of punches, chisels, drills, pocket wrenches, etc.

24 DIAMOND WHEELS AND MILLS—Precision Diamond Tool Co., Chicago, Ill. 4-page folder illustrates and describes precision diamond metal-bonded wheels and mills for internal and external grinding and Castweld diamond-tipped tools. Specifications and operation instructions for many types.

25 DRILL VISES AND CASTING HAMMERS—Johnson Tool Co., Inc., E. Providence, R. I. 4-page folder describes and illustrates how to cut time with the Shur-Grip drill vise. Also 4-page folder on casting hammers with mould and ladle, including prices.

HEAT-TREATING AND WELDING

26 WELDING PROCEDURE—Air Reduction Sales Corporation, New York, N. Y. 54-page wire bound book gives valuable data on choosing process to be used and on welding all metals. Data on electrode consumption, gas welding rod consumption and approximate gas consumption for oxyacetylene welding. Includes forms for tabulating cost data. Real reference on welding, with detailed data.

27 WELDING POSITIONERS — Cullen-Friestedt Co., Chicago, Ill. 16-page bulletin WP-22 describes C-F positioners for faster, better and more economical welding. Gives functions, investment value, features and installation suggestions.

28 ELECTRIC SALT BATH FURNACES —Ajax Electric Co., Inc., Philadelphia, Pa. 20-page illustrated booklet on heat treatment in Ajax-Hultgren electric salt bath furnaces shows installations of various electric salt bath furnaces. Operating principles discussed, standard sizes shown, with much data of value to users.

29 MOLTEN SALT BATHS—E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. 75-page illustrated, wire-bound catalog with technical details on cyanide hardening, reheating, and nitriding, du Pont salts, heat coloring, salt bath equipment, cyanide disposal, analytical methods, safety and first-aid. Includes hardness conversion table, temperature conversion, S.A.E. steel analyses and critical temperatures.

30 PORTABLE WELDERS — Sciaky Bros., Chicago, Ill. 26-page illustrated catalog on Radial Portable Welder for use where ordinary ones can't reach, describes distinctive features and gives design data on welds.

PLANT SERVICE EQUIPMENT

31 CONVEYORS — Standard Conveyor Company, North St. Paul, Minn. 24-page illustrated catalog 307 gives complete information on conveyors engineered to meet all package handling problems. Shows interesting conveyor and pneumatic tool applications of interest to engineers, plant managers, superintendents, etc.

32 DUST AND FUME COLLECTORS—Claude B. Schneible Co., Chicago, Ill. 4-page folder describes multi-wash dust and fume collector for gangs of grinders. Efficient multi-wash dust control in a compact, midget unit. Complete and ready to plug into electric outlets.

PARTS AND MATERIALS

33 STAINLESS STEEL FABRICATION —Republic Steel Corp., Massillon, O. 40-page illustrated booklet gives authentic information on proper procedure for all operations. Valuable references.

34 MACHINING ALUMINUM — Aluminum Corporation of America, Pittsburgh, Pa. 43-page booklet gives complete data on general machine practice, automatic screw machine practice and many valuable ways of conserving metal. Good user's manual.

35 HIGH SPEED STEEL—Jessop Steel Co., Washington, Pa. 12-page illustrated booklet describes new TCM high speed steel with information on advantages and performance and tables on analysis, typical applications and heat treating procedure.

36 STANDARD STEELS—American Steel & Wire Co., Cleveland, O. Wall chart listing AISI, SAE and NE standard steels including nearest aeronautical material specifications. Handy chart and reference.

37 STEEL HANDBOOK—Union Drawn Steel Division, Massillon, O. 83-page steel handbook, No. 42 for machine tool users gives collection of data and information designed to aid steel user in selecting right steel for right purpose while securing highest efficiency in production processes.

38 HARD RUBBER—Joseph Stokes Rubber Co., Trenton, N. J. 31-page illustrated hard rubber manual describes uses, compositions, molding, various forms, machines, collars, molds, and many other factors important to users or potential users.

39 MOTOR AND CONTROL SELECTOR —Westinghouse Electric & Mfg. Co., Pittsburgh, Pa. Pocket-size slide rule selector to guide selection of proper types of motors for each of 44 industrial applications. Specifications, performance ratings and control classes for required type readily determined.

FIRST CLASS
PERMIT No. 10
(Sec. 510, P.L.&R.)
NEW YORK, N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

4c. Postage Will Be Paid By—

AMERICAN MACHINIST
330 West 42nd Street
New York, N. Y.

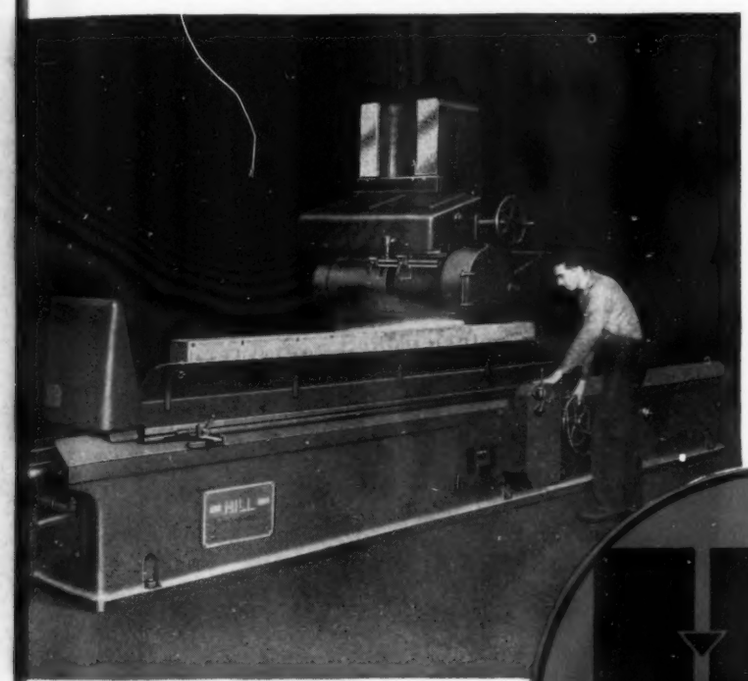
FIRST CLASS
PERMIT No. 10
(Sec. 510, P.L.&R.)
NEW YORK, N.Y.

BUSINESS REPLY CARD
NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

4c. Postage Will Be Paid By—

AMERICAN MACHINIST
330 West 42nd Street
New York, N. Y.

Reaching PRODUCTION GOALS with HILL "open side" HYDRAULIC SURFACE GRINDERS



Unusual production increases reported by users of HILL *"Open Side"* Hydraulic Surfarce Grinders are attributable to the fact that HILL Grinders are *designed* and *built* for continuous heavy duty grinding. • Available in both Horizontal and Vertical Spindle types, these *companion* Grinders cover an extensive range of applications. • Manufactured in table widths 18", 24", 30" and 36" in the Horizontal Spindle type, and 18", 24" and 30" in Vertical Spindle type. Table lengths range from 5 to 20 feet.

HORIZONTAL

VERTICAL

★ ★ ★ ★ ★ ★

Featuring

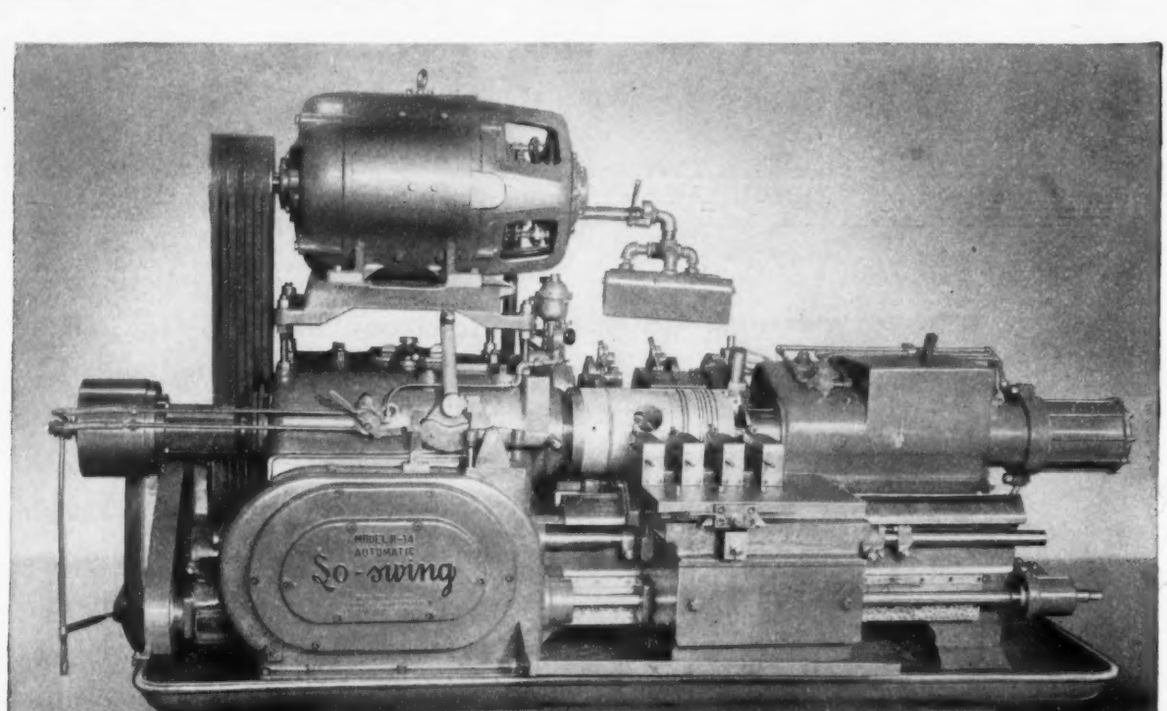
Massive Construction, "Open Side" Convenience, 100% Hydraulic Drive, Centralized Controls *and* Permanent Accuracy

The HILL ACME Co.

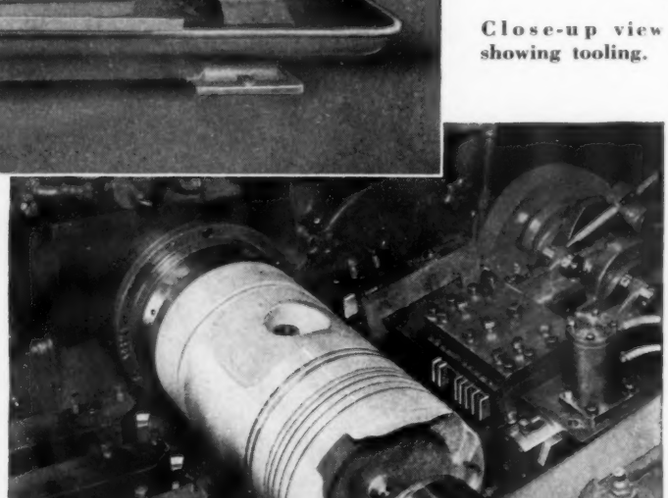
6400 BREAKWATER AVE • CLEVELAND, OHIO

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE *Lo-swing* PEOPLE" SENECA FALLS, NEW YORK



Front view of machine with belt cover removed to show V-belt drive.



Close-up view showing tooling.

Lo-swing MODEL R-14 LATHE EQUIPPED FOR TURNING LARGE SIZE DIESEL MOTOR PISTONS

Problem: **To automatically turn, groove and face special alloy pistons having a maximum diameter of 10.5".**

Solution: **The Model R-14 Lo-swing was selected for this job due to its rigidity and "Simplified Change-over Mechanism" which permits changing over from one size piston to another in a few minutes by simply making a few adjustments in gear segments which control cross slide movements.**

The work is centered on the driven end with an adapter plate machined to fit the bore of the open end of the piston which has been previously machined. This adapter is fitted with a hardened steel driving plate which contacts a lug cast on the inside piston wall, assuring a positive drive. The piston is supported on the tailstock end with a standard 60° revolving type center.

The turning operation consists of machining the outside diameters with four tools mounted on a single cross slide 17" wide. The grooving and facing tools are clamped on two independently operated Back Squaring Attachments, the movements of which are synchronized with the front slide.

The end facing tool is mounted in a special relieving type tool block (see close-up view) which automatically relieves the tool on the return stroke, preventing any scoring or marking of the finished face. The relief mechanism is controlled with a small cam mounted on back attachment cam shaft and may be set to obtain tool relief at any time during the operating cycle.

Sintered carbide tools are used on this job and a high grade finish is obtained on the ring grooves.

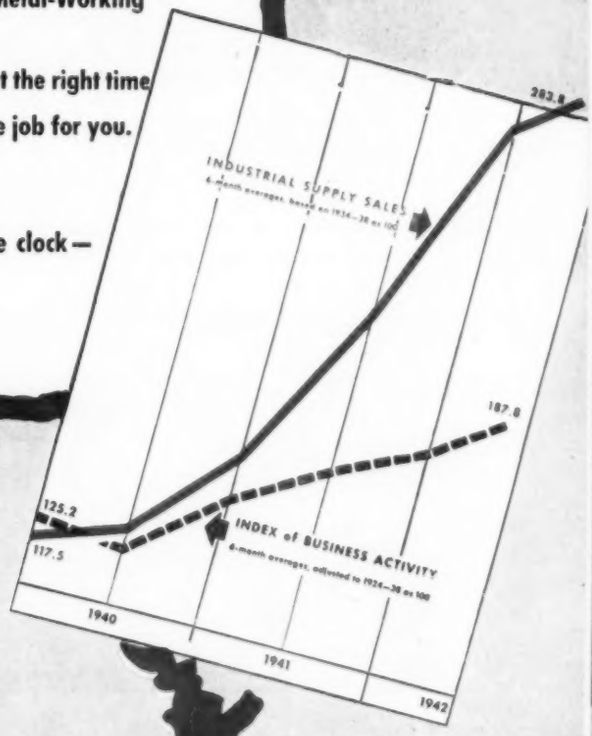
LATHE NEWS from SENECA FALLS

THIS IS A WAR OF *LOGISTICS*

Between San Francisco and Sydney lie 8,000 wet miles.
From New York to London there are 4,000 storm-tossed ones.
New York to Murmansk is almost 5,000.
Hitler battles 1,400 miles from the Ruhr to Russia,
With American-built bombers at both ends and along the way.
Hirohito struggles 3,000 miles from Tokyo to Rabaul . . .
With Uncle Sam's submarines under the waves and his bombers above.

Yes, this is a war of logistics—the military word for the science of supply—
Supplies of planes, tanks, trucks, guns, shells
To the right place, at the right time.
For both the strategy and the tactics of these United Nations
Depend on the logistics of these United States.

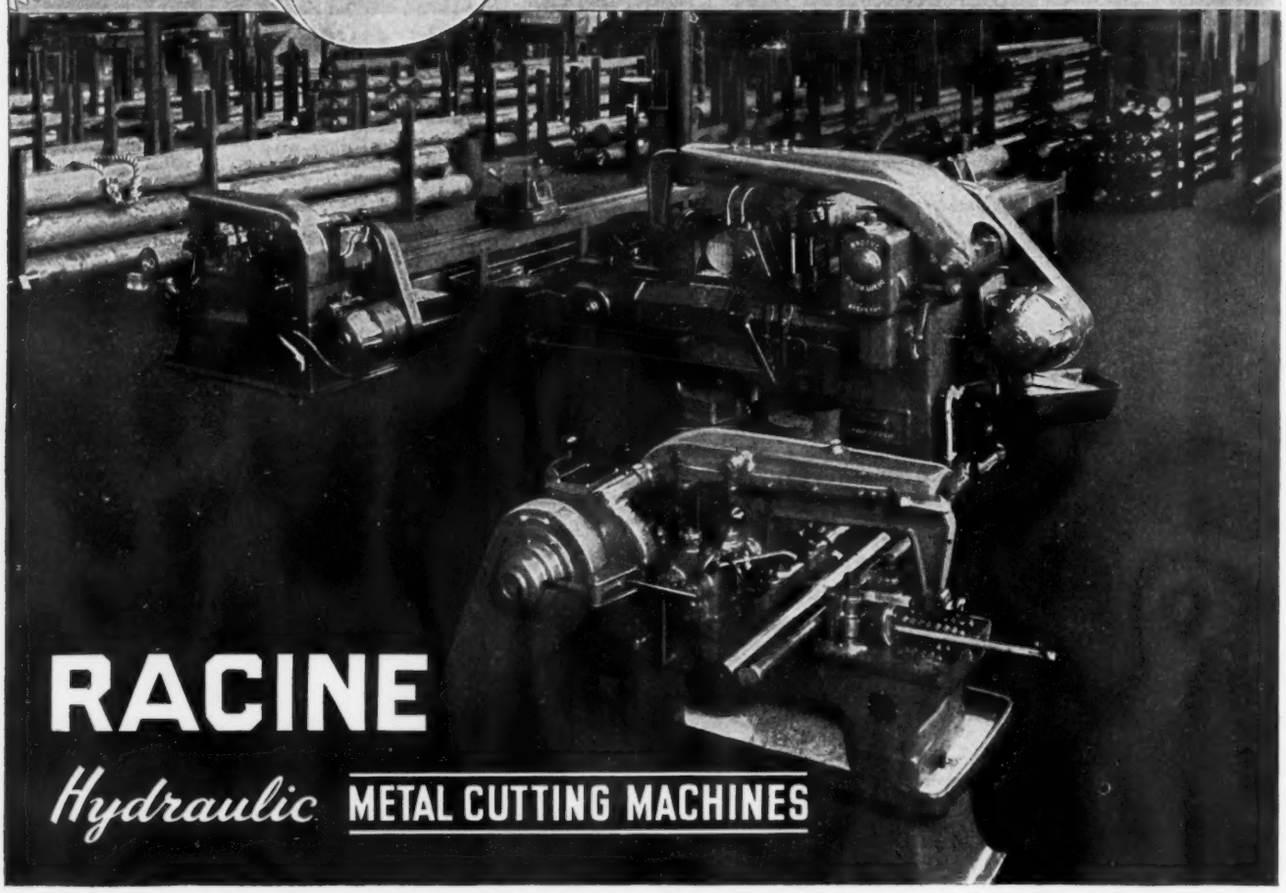
That's why supplies within the United States, and within Metal-Working
Have become so important.
Metal-Working must have the right tools at the right place at the right time.
Better than anyone else, your Industrial Distributor does the job for you.
He's a master of industrial logistics.
Hence the sharp increase in war business through him
Is but recognition of efficient services rendered 'round the clock—
Recognition for sound distribution methods
That have now proved their value under fire . . .



KEEP YOUR SUPPLY LINES O[illegible] BY BUYING
THROUGH YOUR INDUSTR[illegible] DISTRIBUTOR

Published in the interest of the industrial distributor by
MILL SUPPLIES, 330 West 42nd St., New York, N. Y.
The Magazine of Industrial Distributors and Their Salesmen

Save Materials by PRECISION CUTTING!



RACINE

Hydraulic METAL CUTTING MACHINES

Illustrated above is a battery of RACINE High Speed metal cutting machines. They are fully hydraulic and embody the latest developments in machine tool design. One of the particular advantages the R. K. LeBlond Mchy. Co. of Cincinnati, Ohio, found with the use of these modern machines was the saving in materials due to straight accurate cutting and in close accurate measuring and gauging of stock by the hydraulic automatic bar feed machines.

RACINE Heavy Duty Hydraulic Saws are designed to cut accurately at faster production speeds. Each machine has a massive saw guide to tension the saw blade. Wide bearing areas contained in the saw frame provide rigid alignment under heavy cutting feeds and maintain accuracy in cutting material from 6" x 6" up to 14" x 20"

RACINE controls cutting pressures by progressively feeding and oil cushioning the blade so that the blade teeth cannot gouge or tear thin walled tubing and soft metals. Powerful hydraulic feeds and sensitive accurate control prevents the blade from flinching or riding away in cutting tough die blocks and alloy steels. Such positive accuracy means safer, faster cutting.

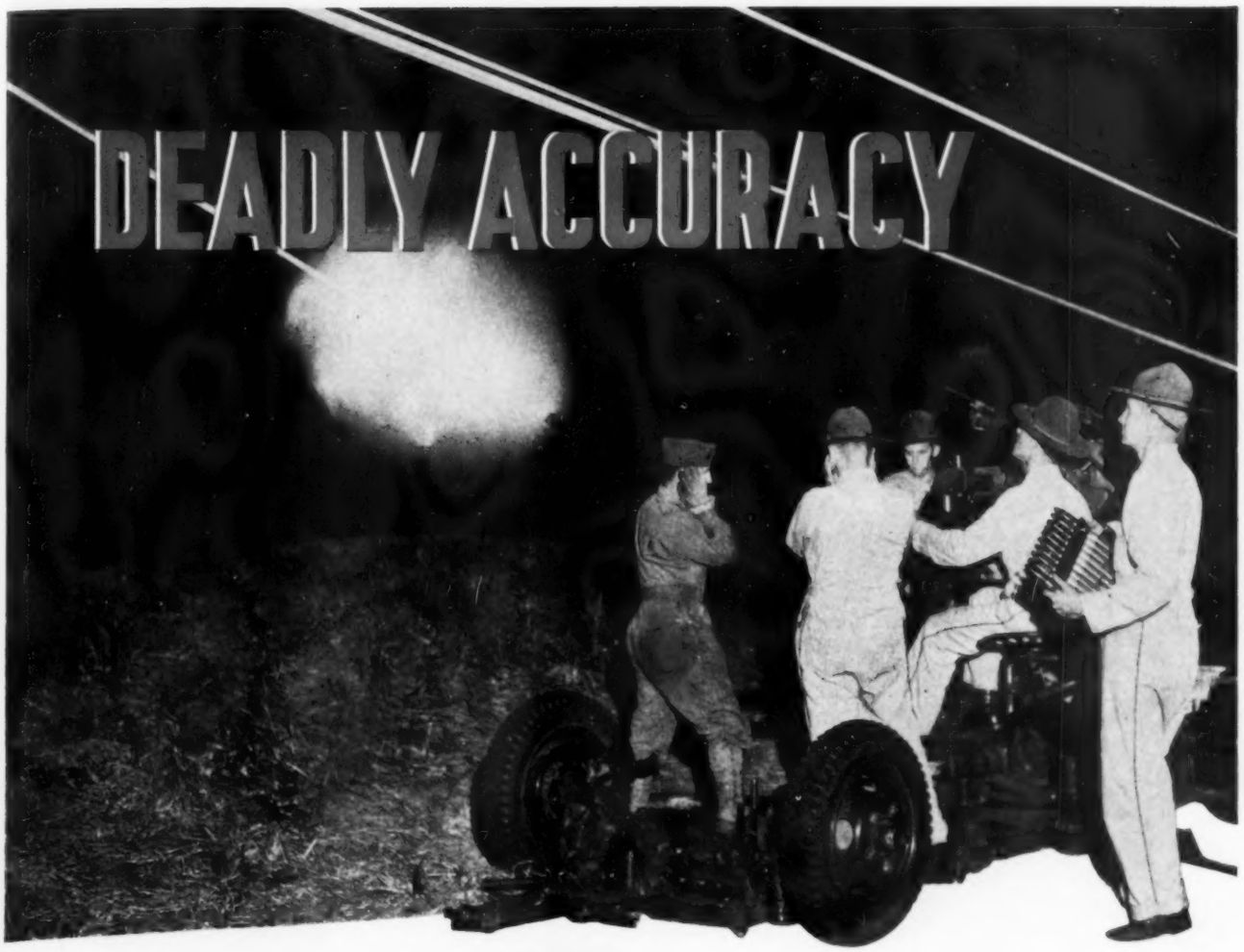
RACINE'S complete line comprises saws for every purpose from general Utility types in 6" x 6" capacity to Heavy Duty production models in 6" x 6", 10" x 10", up to 14" x 20". Hydraulic automatic bar feed machines available in 6" x 6" to 12" x 16" capacity. Write today.

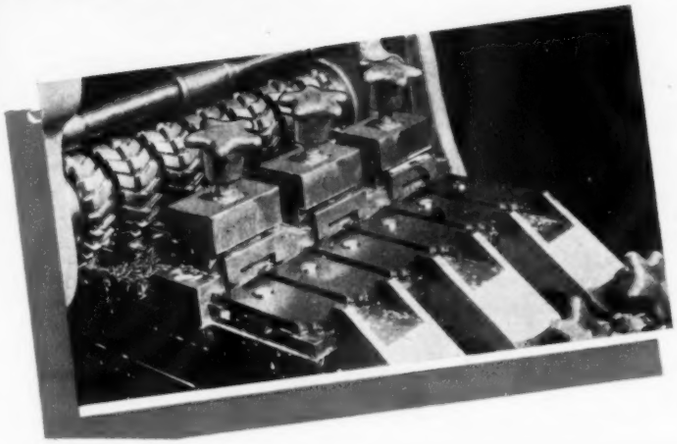
"STANDARD THE WORLD OVER"

RACINE TOOL & MACHINE CO.

1752 STATE ST. ··· RACINE, WIS.

DEADLY ACCURACY





LITERALLY snatching an enemy bomber out of the sky requires the utmost marksmanship of which men and guns are capable. Much depends upon the gun.

Much depends, also, on the tools that make the gun. National Cutting Tools are tools of *character*, built for hard use, long life, exacting precision.

NATIONAL

NATIONAL TWIST DRILL & TOOL © DETROIT U.S.A.

TWIST DRILLS
REAMERS, HOBS
MILLING CUTTERS
COUNTERBORES
SPECIAL TOOLS

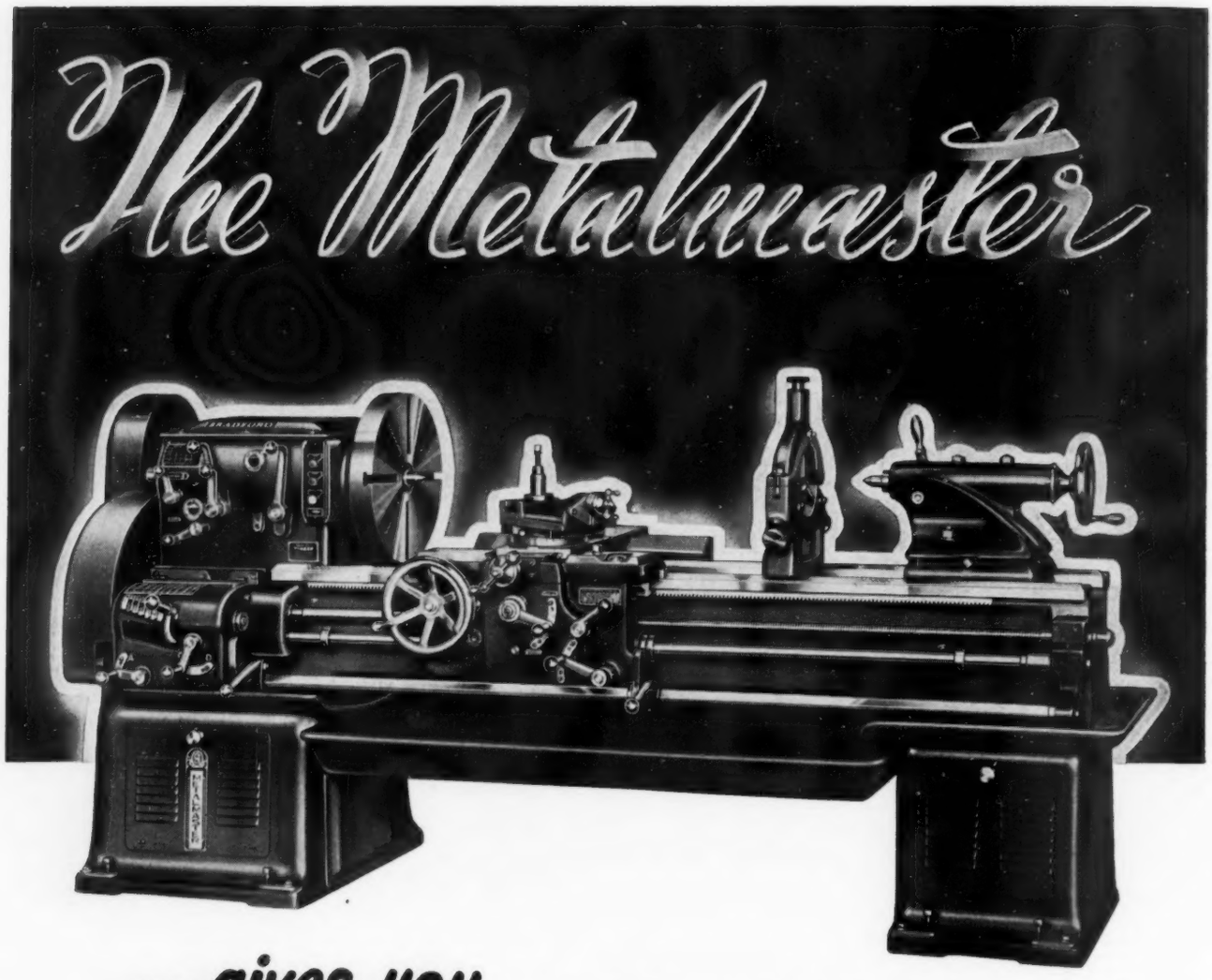
TWIST DRILL AND TOOL COMPANY

HOME OFFICE AND FACTORY—DETROIT, MICH.

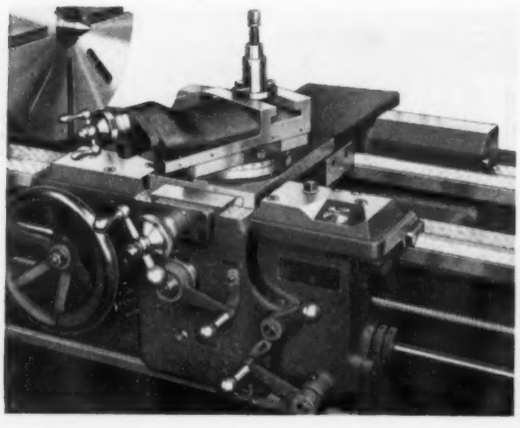
Tap and Die Division—Winter Brothers Co., Wrentham, Mass.

Factory Branches • New York • Chicago • Cleveland • San Francisco • Distributors in Principal Cities

The Metalmaster



...gives you Stamina at the "turning point"



THE CARRIAGE—has carefully planed, exceptionally long wings. A large "V" way at the front and a wide flat way at the rear, solidly gibbed, prevents climbing under heavy cuts. Both gibs may be adjusted to compensate for slight wear. Synthetic shear wipers, immune to oil and coolant, protect bearing surfaces. The bridge is wide and heavy with a large dovetail section for the cross slide. A chasing dial is an integral part of the carriage, being set into the right wing on an angle (for easy reading). Large dials reading in thousandths are provided on cross slide and compound rest. Rear of carriage is planed and tapped so taper attachment can be added . . . . side of bridge, too, is similarly machined for a follow rest. In short, here's STAMINA at the "turning point" . . . . a sound basis upon which to build efficient turning practices.

THE COMPOUND REST—features an offset feed handle. Solidly gibbed to cross slide for its entire length, it's carefully scraped for long wear and rigidity under the heaviest cuts. This compound rest will retain its accuracy over an unusually long working period. Swivel base is graduated in degrees for full circumference, and can be read from either right or left side. Tool post (round pattern type) has hardened ring and wedge, and comes as regular equipment. Rest can be set at right angles. Plain or special rests can be furnished at additional cost.

METALMASTER LATHES—12", 14" and 16" sizes.

Have you the new METALMASTER Bulletin M-M-1, covering all features of this new unit? Write today for a free copy!

The BRADFORD MACHINE TOOL Co

MANUFACTURERS OF METAL WORKING LATHES; CAM FEED DRILLING AND TAPPING EQUIPMENT, HYDRAULIC DRILLING MACHINES . . . IN BUSINESS SINCE 1840

659 EVANS AVE. . . . CINCINNATI, OHIO

"We'll find Chucks that size if they're anywhere in town"

Like hundreds of other plant items, even the best chucks—or anything else for that matter—wear out *some* time.

If new stocks are scarce and your want is immediate, you "need a friend" in a big hurry. *Here he is,* all set to give you the help you need—just call the Representative of your nearby Industrial Supply Distributor. For, even if *he* hasn't any in stock, he is almost sure to know many possible sources that may be closed to you. So when he says "don't worry—we'll scout up an emergency supply for you if there's any in town," you can be sure he will make every effort to keep you going. And usually he will *succeed.*

It's good business to take your own Distributors into your confidence and use them all the time. We know, because for many years they have been *our* Sales Representatives on Cle-Forge High-Speed Drills and Peerless High-Speed Reamers throughout Industrial America.

This incident is typical of the unusual services that many Mill Supply Distributors are rendering their customers during the Emergency.

The CLEVELAND TWIST DRILL COMPANY
1242 EAST 49th STREET
CLEVELAND

TRADE MARK REG. U. S. PAT OFF AND FOREIGN COUNTRIES

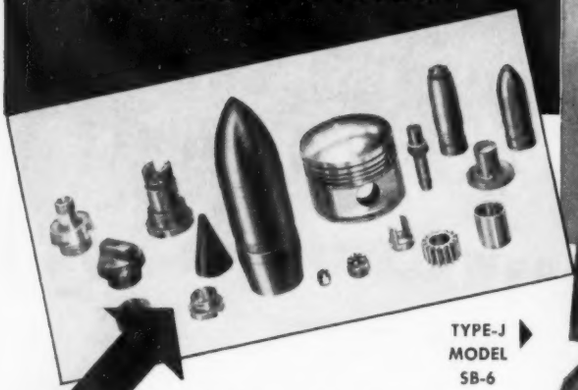
30 READE ST. NEW YORK · 9 NORTH JEFFERSON ST. CHICAGO · 650 HOWARD ST. SAN FRANCISCO
6515 SECOND BLVD. DETROIT · LONDON - E. P. BARRUS, LTD. - 35-36-37 UPPER THAMES ST. E.C.4

"CLEVELAND" DISTRIBUTORS EVERYWHERE ARE READY TO SERVE YOU

AUTOMATIC FINISHING MACHINES

Hammond OF KALAMAZOO

BURRING, BRUSHING, POLISHING OF PLATED OR BASE METALS



TYPE-J MODEL SB-6

HERE ARE A FEW OF MANY PARTS DONE ON Hammond AUTOMATICS

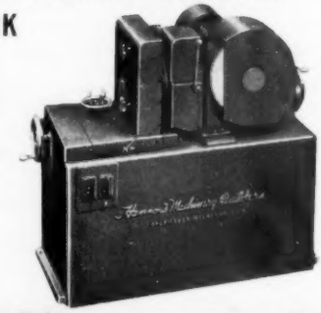
These Hammond high-production 6 and 8 spindle table automatics are in use now — "helping to win the battle of production." If you have a problem in Burring, Brushing, Polishing or Buffing plated or base metals in plane parts, tank parts, bomb parts, and shells, send us samples — some in the rough — one acceptable finished piece — for complete engineering report. Don't delay, do it today!

VISIT OUR BOOTH D-122 METAL SHOW CLEVELAND OCT. 12-16

Hammond "OD" CYLINDRICAL FINISHING MACHINES

FOR ¼" TO 9" OUTSIDE DIAMETER WORK

The Hammond "OD" (outside diameter) Cylindrical Finishing Machine, using for the polishing member various types of wheels — or abrasive belt with backstand to finish the work, is the best means of higher production for you. Flexibility of the machine is controlled by special fixtures and adapters, designed and engineered by Hammond. If you have a problem in cylindrical shapes, send samples of pieces on which a finish is desired together with a finshed piece for a complete engineering report. Do it today, don't delay!



Hammond Machinery Builders INC.

1618 DOUGLAS AVENUE • KALAMAZOO • MICHIGAN

EASTERN BRANCH - 71 WEST 23RD STREET, NEW YORK CITY

4 FEATURES

No. 2 AMERICAN
PLAIN MILLING MACHINE

that assure

- **SPEED**
- **ACCURACY**
- **CONVENIENCE**

in munitions manufacture

1. *INFINITE SPINDLE SPEEDS*

Ability to select the proper speed for the work required is obtained instantly while machine is in operation, by a single direct reading dial control within easy reach of the operator for efficient operation.

2. *MOTOR-IN-BASE DRIVE*

Machine is driven by the U.S. Vari-Drive ball bearing equipped motor located in base. Drive to spindle is by multiple Vee belt through TWIN-DISC Duplex Machine Tool Clutch.

3. *STANDARDIZED SPINDLE NOSE*

Spindle, accurately ground to size, is of heat-treated chrome-nickel steel and runs in heavy phosphor bronze bearings compensated for wear and equipped with alemite lubrication fittings. Flanged spindle nose is standardized having a number 40 taper.

4. *STURDY CONSTRUCTION*

Column is heavily proportioned and houses motor drive and all power shafts. Table is designed for long-lived alignment and permanent shape. Working surface of table is provided with generous oil pockets and with three Tee-slots.

Delivery 8 Weeks With High Priorities

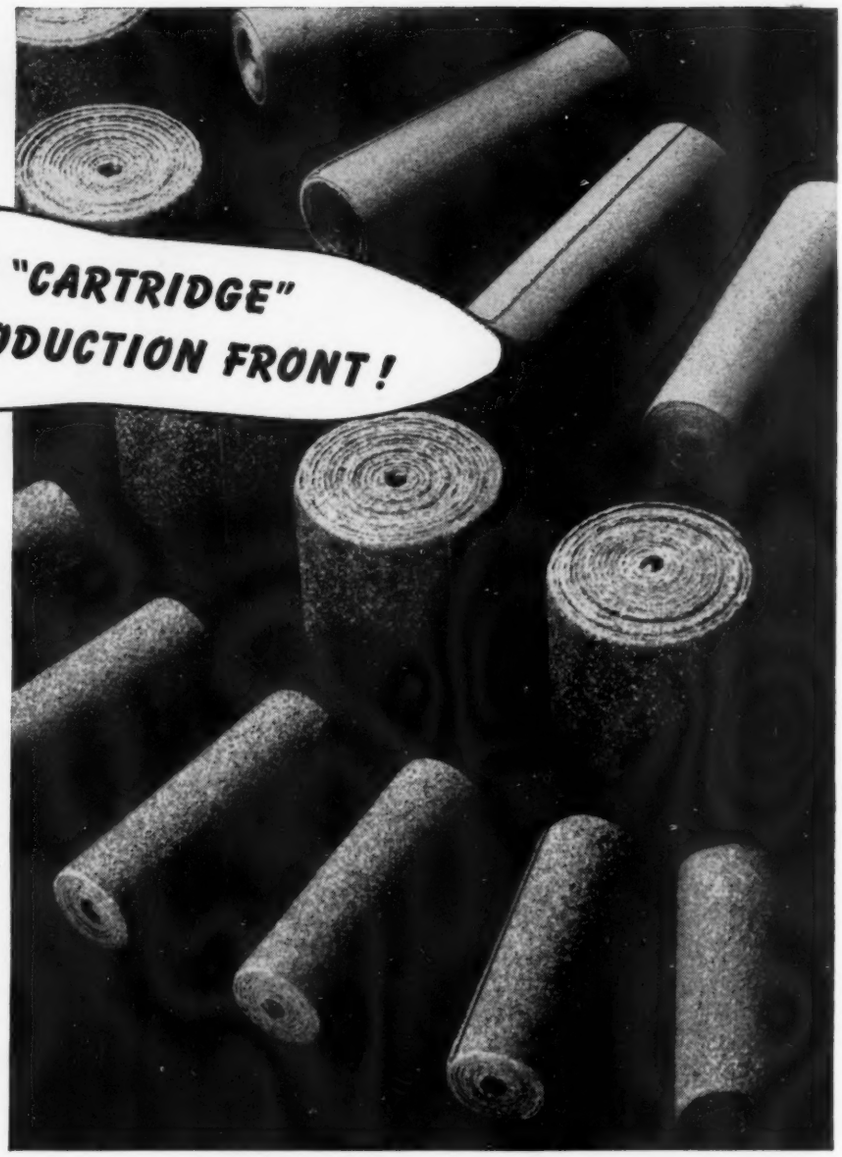
OTHER FEATURES AND DETAILS

. . . table provided with both power longitudinal and transverse feeds.
. . . all speed changes, feed changes, push button control and clutch lever centrally located.
. . . table working surface: 46"x10½".
. . . longitudinal power feed: 25".
. . . transverse power feed: 9".
. . . vertical hand feed: 19".
. . . spindle speed range: 25-500 R.P.M.
. . . geared feeds: 16; (range) .005 to .212" per revolution of spindle.

WRITE AT ONCE FOR
Bulletin giving Detailed Description and Specifications

J. L. LUCAS & SON
INCORPORATED
BRIDGEPORT, CONN. U. S. A.

A NEW TYPE OF "CARTRIDGE" FOR THE PRODUCTION FRONT!



NEVER before has the metal working industry been called upon to grind, finish or polish such a bewildering variety of parts, fittings and finished products. And never before has there been such a demand for improved metal finishing techniques.

To supply this demand and enable users to keep pace with war production demands, The Carborundum Company has developed many new and novel coated abrasive devices — Weapons for Production, which make possible faster production at lower cost.

One of the most interesting of these is the cloth cartridge roll for finishing otherwise hard-to-get-at surfaces. It is simply a tightly wound glued strip of metal working cloth. The center bore formed by the winding is easily pressed onto a spindle of suitable diameter and length. It is then ready to use on a flexible shaft, air or electric tool.

Sizes range from ⅜″ to 1″ in diameter and 1″ to 3″ in length. Grit sizes range from 24 to 320.

These rolls have been found exceptionally effective in finishing, cleaning or polishing out-of-the-way surfaces that are hard to reach, yet must be finished.

The cartridge roll operates much like a mounted abrasive wheel but has the added advantage of being somewhat resilient. It is also economical and long-lived. As the abrasive surface wears down the cloth backing can be unwound and torn off to expose a fresh layer of abrasive.

If you care to see and feel and try one of these cartridge rolls we will be glad to send you one free of charge. Simply address your request to Dept. AM, The Carborundum Company, Niagara Falls, N. Y.

CARBORUNDUM
ABRASIVE PRODUCTS

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

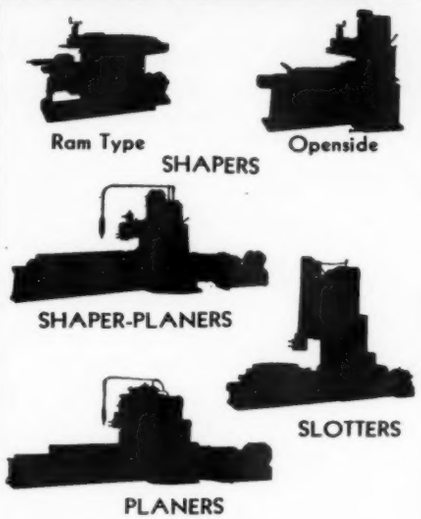
REG. U. S. PAT. OFF.

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum is a registered trade-mark of and indicates manufacture by The Carborundum Company)

Damn Tootin' We Are United...And

RECIPROCATING
Hy-Draulic
MACHINE TOOLS



Exclusive Advantages

Proved in commercial service and on war work, Hy-Draulic Machine Tools give you exclusive features and advantages that promote new high production, quality and economy. Investigate! Write, today, for illustrated bulletins and complete information. Order machines *now* for future requirements and delivery in accordance with official priority ratings.

Building *Hy-Draulic* Machine Tools As Fast As It Can Be Done Right

From front door to shipping floor, through all departments of shop and office, we are united in building Hy-Draulic Machine Tools as fast as it can be done right. Day and night, including Sundays and what used to be holidays, everybody here works on long-shift schedules — and everybody *works.* For more money? Sure . . . it takes more now to support families and the war effort. Equally sure it is that money alone could never induce our people to give up home life, leisure, vacations and all the rest — as they do voluntarily. For what, then?

For Freedom — All Hy-Draulic Machine Tools now produced go immediately into direct war work. Their hydraulic drives and feeds make it easy for operators to get high output and accuracy, to make every minute count, wherever the machines are installed. Thus, Hy-Draulic Machine Tools fight for the Four Freedoms just as surely as do bombs and bullets delivered F.O.B. Berlin and Tokyo. Our people know this. So we all stick together and work together, united in doing our utmost for Victory and lasting Peace.

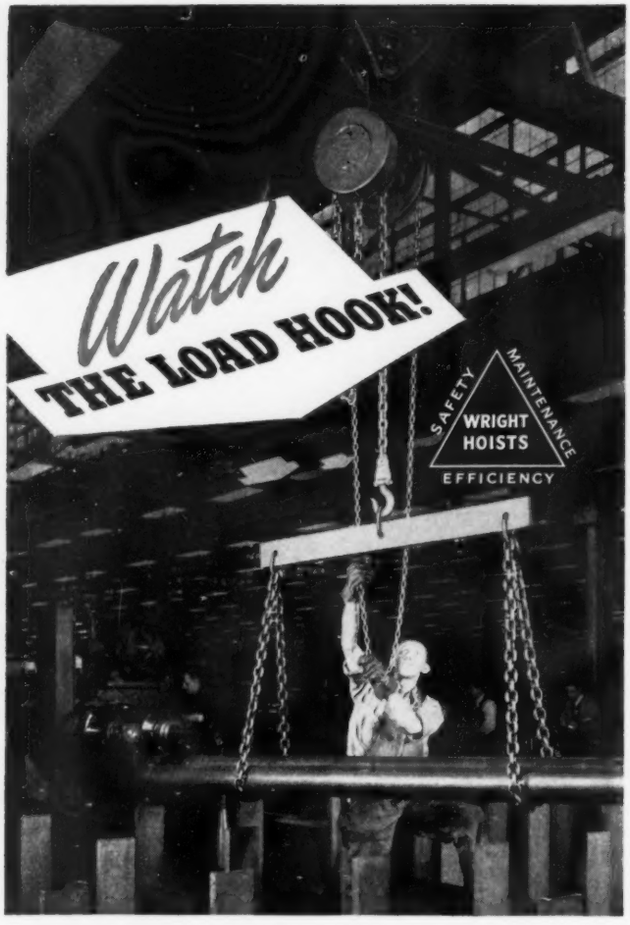
Hy-Draulic
Reg. U. S. Pat. Off.

Shapers..Planers..Slotters..Shaper-Planers

ROCKFORD MACHINE TOOL CO.

ROCKFORD, ILLINOIS, U.S.A.

MADE IN ROCKFORD, ILLINOIS, U. S. A.



★ In one of their recent bulletins on hoists, the National Safety Council says:

> ❝ *Hooks which have become bent on account of overloading should not be straightened and put back in service, but a new hook should be provided. When a hook is once bent the stress in the metal tends to weaken it so that afterward its strength is a matter of doubt and cannot be depended upon.* ❞

That's good advice. With the lives of American boys utterly dependent upon our industrial production, this is no time to take chances which may cause lost time accidents to men or machines, or both.

Watch the Hooks. Wright load hooks are drop-forged from special steel which, when subjected to excessive overloading, give visible warning by opening slowly. When the bottom hook has started to open, look to the top hook, too, for while it is stronger than the bottom hook, it also may be reaching a danger point.

Don't Abuse Your Hoist. Now that we are all faced with restrictions and shortages proper maintenance is of paramount importance. While every **WRIGHT HOIST** is built with load-carrying factors considerably in excess of their rated capacities, like many other well-made pieces of mechanical equipment built for specific duty, they should not be overloaded. Overloading is dangerous—to men, materials, machinery and steady production. Remember—abuse to machinery today is akin to sabotage. Conserve steel and maintain production schedules by careful use, regular inspection and proper lubrication.

WRIGHT MANUFACTURING DIVISION
YORK, PA. CHICAGO SAN FRANCISCO NEW YORK

In Business for Your Safety

ACCO

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

TUNGSTEN CARBIDE TIPPED TOOLS

Price $1.00 Each In Any Size

New Low Prices — Increase Production — Cut Operating Costs

Tools are tipped with Tungsten Carbide, and are suitable for machining cast-iron, brass, bronze, aluminum, non-ferrous materials such as hard rubber, bakelite, fibre, and tough alloy steels up to 500 Brinell hardness

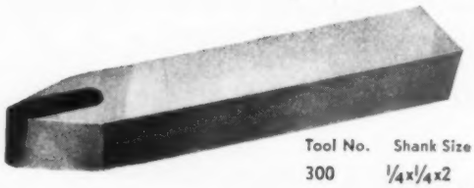
Left Hand-Reverse Image. Right Hand Shown

SERIES 100

Tool No. RH	Tool No. LH	Shank Size
R-100	L-100	1/4x1/4x2
R-101	L-102	5/16x5/16x2 1/4
R-103	L-104	3/8x3/8x2 1/2
R-105	L-106	7/16x7/16x3
R-107	L-108	1/2x1/2x3 1/2

SERIES 200

Tool No.	Shank Size
200	1/4x1/4x2
201	5/16x5/16x2 1/4
202	3/8x3/8x2 1/2
203	7/16x7/16x3
204	1/2x1/2x3 1/2



SERIES 300

Tool No.	Shank Size
300	1/4x1/4x2
301	5/16x5/16x2 1/2
302	3/8x3/8x2 1/2
303	1/2x1/2x3 1/2

Standard Tungsten Carbide Tipped Tool Bits

In lots of 12 assorted in any Series; 100-200-300 Series an extra 10% will be allowed; also in lots of 50 assorted 20% discount will be allowed.

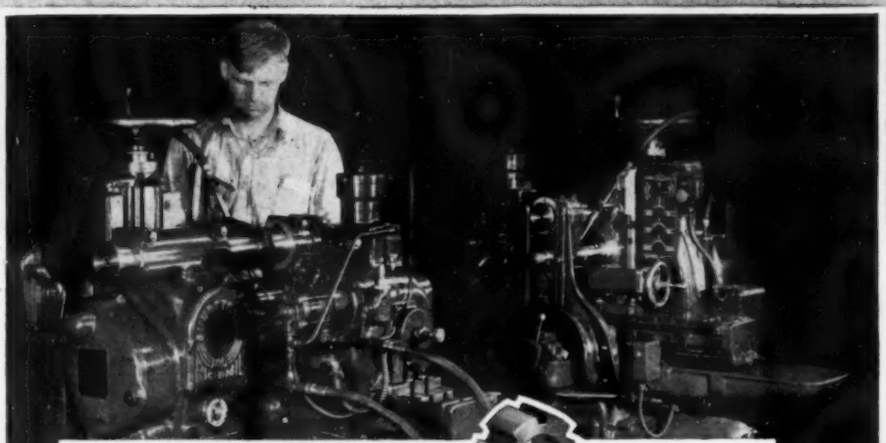
Sizes not listed as well as special TIPPED TOOLS will be quoted upon request. When ordering, state tool number and quantity desired.

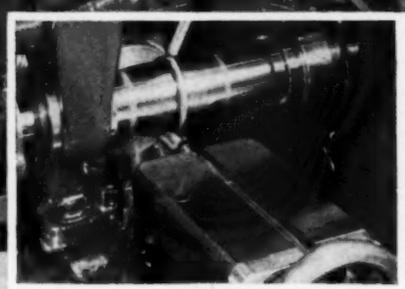
WE CARRY SILICON CARBIDE EMERY WHEELS FOR GRINDING TUNGSTEN CARBIDE TOOL BITS

Send for our new 1941 general catalogue

VICTOR MACHINERY EXCHANGE, Inc.
251 CENTER STREET NEW YORK, N. Y.

Engineered Production





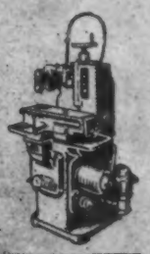
Job Data

Part — Roller, of S.A.E. 4140 steel, 0.750" diameter, 0.3125" face. Mounted 5 per arbor.

Operation — Mill six grooves, held to ± 0.0002" on spacing, width and depth.

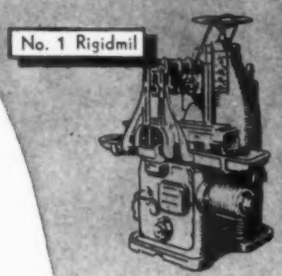
Equipment — Two No. 0 Rigidmils, with automatic hydraulic indexing fixtures, illustrated.

Results — Former production increased 320%. One operator runs both Rigidmils easily. Additional advantages, listed below, many more in bulletin.



No. 00 Rigidmil

No. 0 Rigidmil



No. 1 Rigidmil

Hydraulic RIGIDMILS Increase Operator Output 320% Hold Accuracy to ±.0002"

For milling six grooves in steel pump rollers as shown above Sundstrand Engineered Production and two No. 0 Hydraulic Rigidmils with automatic hydraulic index fixtures increases operator output 320%. What's more, the close limit of ±.0002" to which this milling operation must be held is more easily maintained because of "built-in" accuracy in Sundstrand Rigidmils and fixtures and the complete automatic cycle which they provide.

Continuous Automatic Cycle — The whole operation of milling 6 grooves in an arbor-load of 5 work-pieces continues automatically after starting. It includes rapid approach, feed, quick return, index, repeat 5 times, and then stop.

Repeated Accuracy — Spacing, width, and depth of cuts maintained mechanically by accuracy built into the Rigidmils and fixtures. Automatic cycle eliminates human element, assures duplication of accurately milled parts throughout run.

Saves Skilled Labor — Operator now merely loads arbor with blank parts and starts full automatic cycle. Six complete table cycles and 5 indexes of fixture are automatic without further attention. One operator easily runs two Rigidmils to produce more parts than he was able to before, with less effort.

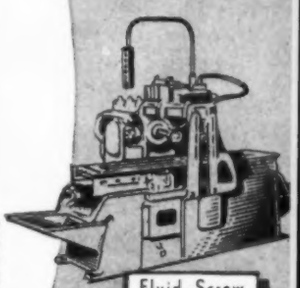
Cuts Checking Time — Automatic hydraulic indexing, and Rigidmil accuracy, cut checking time to routine inspection at start of a run, and occasional examination for cutter wear.

Reduces Rejects — Rigid mechanical control of accuracy, assures perfect product, reduces rejects and spoilage.

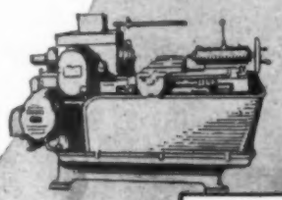
Other Uses — These Rigidmils can be applied easily to many different milling jobs simply by substituting other fixtures and cutters. See Bulletin 905 for details. Ask about other Rigidmils. Consult our Engineered Production Department about new equipment for any milling operation.

Get NEW Bulletin

New bulletin on No. 0 Rigidmil illustrates and describes impressive production-increasing and labor-saving operations; shows 26 features, 9 cycles, specifications and other data. Get your copy, today. Write now for Bulletin 105.



Fluid-Screw Rigidmil

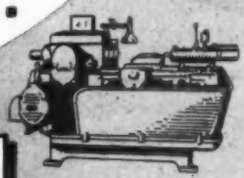


Model 12 Automatic Stub Lathe

Sundstrand Machine Tool Co.

2533 Eleventh Street, Rockford, Illinois, U. S. A.

Model 8 Automatic Stub Lathe



Model 10 Automatic Stub Lathe

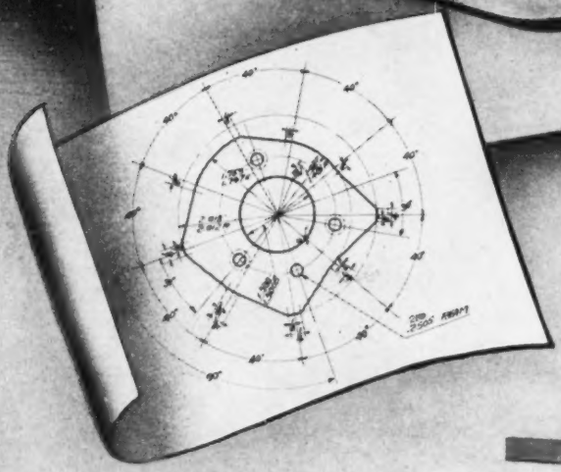
In their respective fields, Sundstrand machine tools are unexcelled for high production, accuracy, and lasting value. Write for complete details.

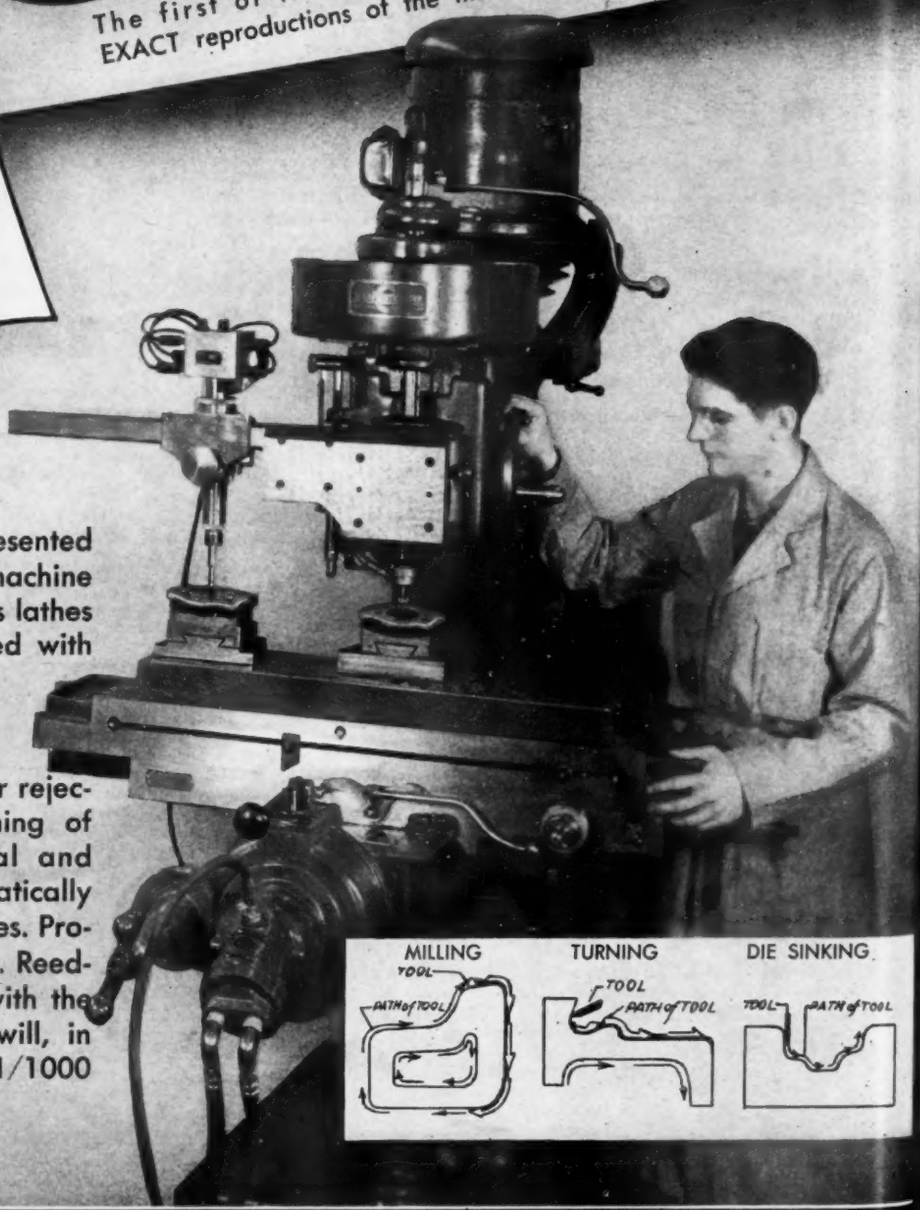
RIGIDMILS · STUB LATHES

Hydraulic Operating Equipment — Drilling and Centering Machines

MADE TO "SPECS"

The first or the thousandth piece
EXACT reproductions of the master cam.





To overcome the problem presented by a shortage of skilled machine operators, Reed-Prentice offers lathes and milling machines equipped with the Detroit Duplimatic. Semi-automatic operation of Reed-Prentice machines is the solution to your rejection problems in the machining of irregular parts. Longitudinal and transverse feeds are automatically controlled to required tolerances. Production is speeded 30 to 50%. Reed-Prentice machines equipped with the Detroit Universal Duplimatic will, in many cases, work to within 1/1000 of an inch.

REED-PRENTICE CORPORATION 1213 W. 3d St., CLEVELAND, OHIO
75 WEST ST., NEW YORK CITY

WORCESTER, MASSACHUSETTS, U.S.A.

Detroit Distributor: KORDENBROCK MACHINERY COMPANY

DURABILITY BEYOND THE "DURATION"

In the first World War Axelson established an enviable record in the production of machine tools for the Allies. After victory was won, Axelson continued developing and improving their lathe so that peacetime manufacturers might benefit by producing their products more quickly and more accurately, holding precision to the highest possible degree.

Today Axelson factories, with their wide experience, engineering skill and complete facilities are again almost entirely devoted to the present war effort. As a Company our entire resources are pledged to Axis defeat. Axelson employees are carrying on the traditions of workmanship and quality.

From out of this terrible world conflict will develop many things of benefit to both industry and individuals. Among them will be a definitely increased rate of industrial evolution and product improvement which will be in direct proportion to stepped-up, intensified production schedules. Today industry is doing jobs in one year that with "business as usual" might have taken twenty years.

Every day Axelson not only produces more lathes but better lathes. We have not lost sight of the truth that there is no economical substitute for quality. Axelson Lathes will be accurately turning out your products long after the rising sun has set and the swastika has crumbled into the dust.

AXELSON MANUFACTURING COMPANY

6160 Boyle Ave. (P. O. Box 98, Vernon Station), Los Angeles, California • 50 Church Street, New York • 3844 Walsh Street, St. Louis • 204 Munsey Building, Washington D.C.

Today over the Axelson Manufacturing Company's Los Angeles plant flies the Army-Navy E Award Flag. Realizing the true significance of this award, every Axelson employee is pledged to carry on wholeheartedly in the task that lies ahead and to achieve even greater excellence in production.

DISTRIBUTORS

Cleveland.....The Brown Tool Company	*Dormont, Pittsburgh*.....Edward W. Voss
Philadelphia.....Albert Hepworth	*Detroit*.....Winterhoff Machinery Co.
St. Louis.....B. C. MacDonald & Co.	*Chicago*.....H. F. Wolnick Machinery Co.
Houston.....McArdle Equipment Co.	*Boston*.....MacKenzie Machinery Co.
San Francisco.....Osborne Machinery Co.	*Los Angeles*....Griffin & Ross Maschinery Co.

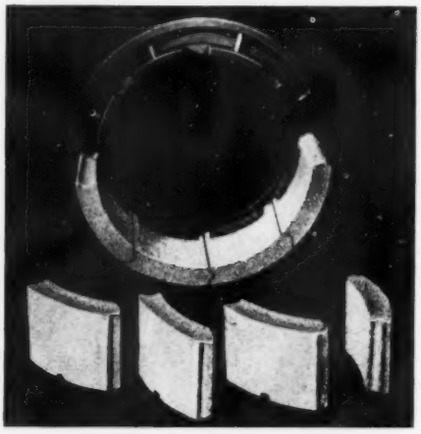
BEFORE YOU BUY ANY LATHE INVESTIGATE AXELSON

Here's A REAL PRODUCTION UNIT *Built For Breaking* YOUR GRINDING RECORDS

WHAT is your grinding problem - armor plate, aircraft parts, gun mounts, tools and cutters, engine parts, automotive parts, large forgings, boiler plate, pumps . . . . ?

Sterling Type 2 Chucks and Segments form a unit that can be quickly set up for cool, efficient, quick surface grinding. Tested by years of service, this grinding unit will live up to your demands for speedier work during these days of production worries.

Downtime hardly exists with Sterling Chucks and Segments. All segments can be set up in a very few minutes by an inexperienced worker. Sterling segments can be used until they are worn to the last inch . a feature that cuts costs and lengthens service.



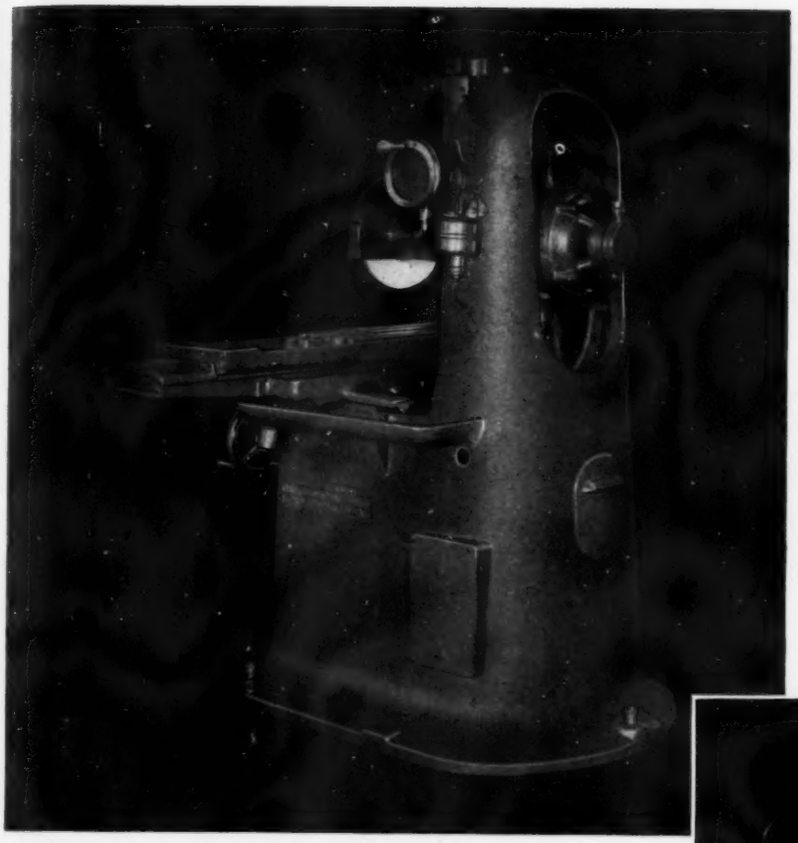
Sterling Chucks and Segments are fully described in Sterling Catalog No. 42 . . . so is all the Sterling line of Grinding Wheels! Write for it today!

Realize the possibilities offered by Sterling Chucks and Segments on your surface grinding jobs. Have a test made today and check with your present method on time saved and superior results gained. There is no obligation . . a grinding survey now may be the means of speeding up your output for months to come. A Sterling engineer is ready to tell you all about this production booster . . . write today.

• STERLING ABRASIVES •

THE STERLING GRINDING WHEEL DIVISION
OF THE CLEVELAND QUARRIES COMPANY
TIFFIN, OHIO

THE WHEELS OF INDUSTRY



THE ABRASIVE No. M3

Surface Grinder with Motorized Spindle

The ABRASIVE M3 Grinder with Motorized Spindle was devised at the request of several customers and combines the advantages of two Abrasive Grinders. Reorders from these customers made it seem wise to add the M3 to our regular line of grinders. The machine itself is the popular No. 3B with full automatic feeds, a fast, accurate, carefully designed machine. The motorized spindle is similar in design and construction to that used so successfully on the No. 1½ hand operated grinder.

The M3 delivers full motor power to the wheel, without vibration, by using a well balanced motor, with the rotor mounted directly on the wheel spindle, eliminating belts, chains, and sprockets. The wheel spindle can be of either the ball or plain bearing type. Longitudinal and transverse feeds are driven by a separate ½ h.p. motor in the base of the machine.

BETTER DELIVERY ON THE M3

Delivery on the M3 Surface Grinder is today months in advance of the 3B due to the fact that this is the first public announcement of this machine.

ABRASIVE MACHINE TOOL CO., EAST PROVIDENCE, RHODE ISLAND, U. S. A.

WRITE OR PHONE NEAREST DEALER

HOME OFFICE
East Providence . . . East Prov. 0549

• • •

RUSSELL, HOLBROOK & HENDERSON, INC.
New York, N. Y. . . . Walker 5-6751

C. H. BRIGGS MACHINE TOOL CO.
Syracuse . . . . . Syracuse 2-4905

THE GEORGE KELLER MACHINERY CO.
Buffalo-Rochester . . . Riverside 1840

SWIND MACHINERY CO.
Philadelphia ..... Rittenhouse 4340
Baltimore ..... Tuxedo 0104
York 4-3404

THE MOTCH & MERRY-WEATHER MACHINERY CO.
Cleveland ..... Main 1000
Pittsburgh ..... Atlantic 3985
Cincinnati ..... Main 2666
Akron ..... University 3075

CHENEY & MORETON
Detroit ..... Trinity 2-5050

MARSHALL & HUSCHART MACHINERY CO.
Chicago ..... Randolph 8860
Milwaukee ..... Edgewood 5576
Rock Island 348
South Bend 4-9555

MARSHALL & HUSCHART MACHINERY CO. OF IND.
Indianapolis ..... Riley 6335
Muncie 4837

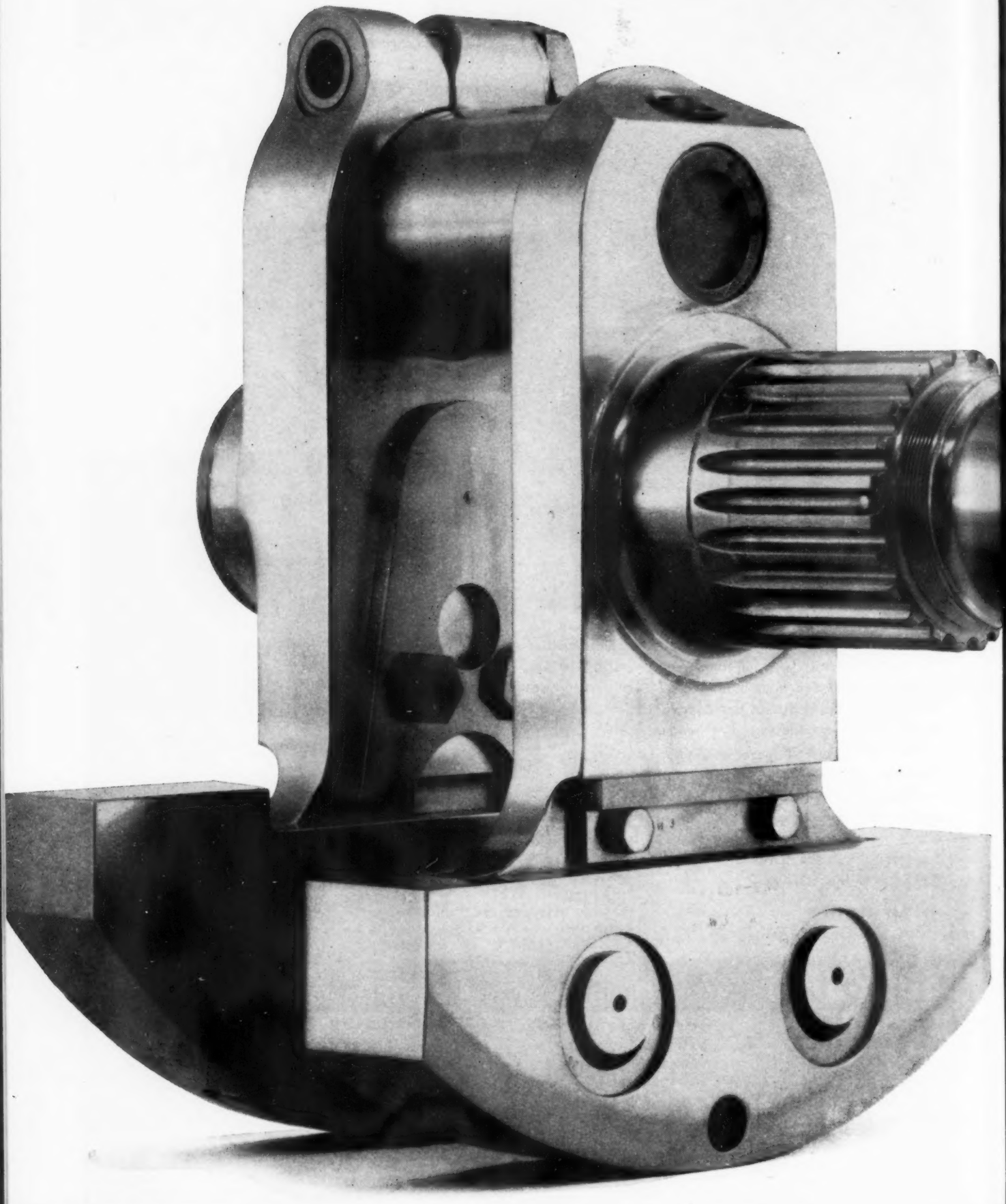
BLACKMAN & NUETZEL MACH. CO., INC.
St. Louis ..... Newstead 0765

TIDEWATER SUPPLY CO., INC.
Norfolk 27311
Asheville 376
Columbia 8169

W. S. MURIAN CO.
Knoxville ..... Knoxville 3-4331

HENES-MORGAN MACHINERY CO. LTD.
Los Angeles ..... Jefferson 7185

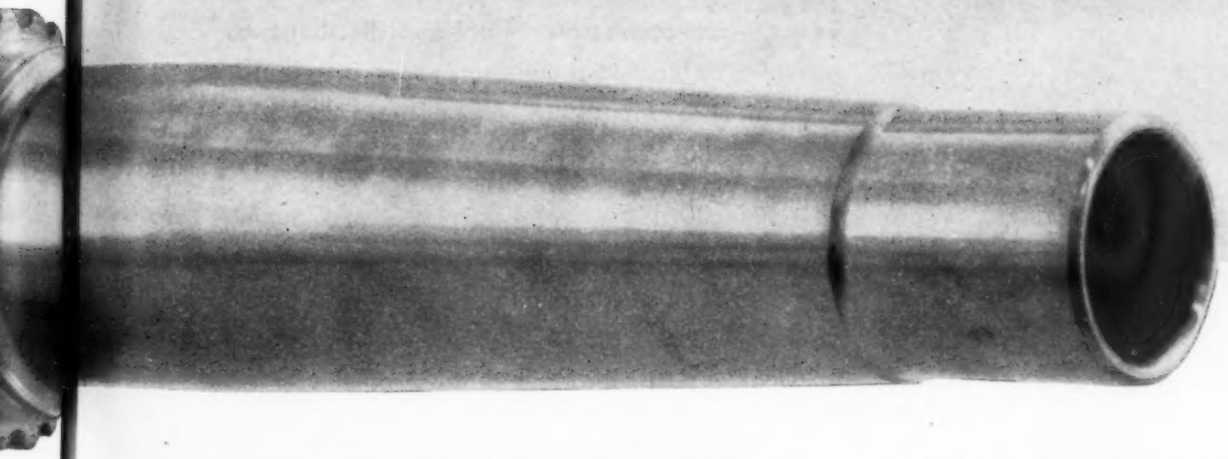
JENISON MACHINERY CO.
San Francisco ..... Valencia 1710



THE CARBORUNDUM

REG. U. S. PAT. OFF.

What's the most important half second in the life of a crankshaft?



YOU'RE looking at one of the sweetest pieces of precision engineering that ever stirred a craftsman's heart. Accurate as the balance wheel of your watch, this airplane engine crankshaft will soon be helping some pilot show the enemy what American men and machines can do.

However, in the split-second in which the final grinding operation on the shaft was completed, had the operator taken off just 0.001 inch more than the minimum diameter specified for the bearing, for instance, the shaft would never have seen action at all. Its value would have been reduced to scrap. And the staggering total of man and machine hours which had gone into it up to that point would have been worth absolutely nothing.

Can you find a single operation in war production where so much is at stake as in the final grinding process? Because of the key role it plays in war output, the grinding operation is one of the first places to check for ways to conserve materials, effort and time.

Make certain that your grinding machines are being operated with the utmost possible care. Make certain too that you are using the right grinding wheel for the particular job at hand. It is a *Weapon of Production* and should be properly used for maximum effectiveness.

Manufacturer's recommendations should be carefully followed on wheel speed, work speed, rate of infeed, wheel traverse, proper coolant and wheel grading (grit, grade and bond). Only the correct balance of these several factors will insure maximum production.

You are cordially invited to visit us at Booth C-122
National Metal Congress Exposition
Cleveland Auditorium, October 12-16.

COMPANY, NIAGARA FALLS, N. Y.

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum and Aloxite are registered trade-marks of and indicate manufacture by The Carborundum Company)

SUNNEN *Precision* HONING

SUNNEN
SUNNEN
WRITE for FREE BULLETIN
—giving complete information and showing many examples of use. Or if you prefer, a Sales Engineer will call and demonstrate this machine in your plant.

For INTERNAL DIAMETERS of .185" to 2.400"

Small • Inexpensive Economical • Greater Accuracy • Super-Smooth Finish

Tool engineers — sub-contractors — tool and die shops, as well as hundreds of leading prime contractors, are speeding up production and cutting costs with this practical honing machine.

Accuracy within .0001" guaranteed — produces super-smooth finish. Corrects errors of out-of-roundness or taper caused by previous operations. Maintains alignment. Facilitates duplication of sizes. Can be set up and work located in a minute. Does not require skilled labor. Relieves big internal grinders for other jobs.

SUNNEN PRODUCTS COMPANY
7941 Manchester Avenue St. Louis, Missouri
Canadian Factory: Chatham, Ontario

SUNNEN

Hardened Steel Ring Gauge—finished to an accuracy of .000025" for roundness and straightness.

Drawing and Blanking Die "Saves time in producing smooth base metal finish."

Inner Bearing Ring "Accurately removes last 'tenth' of stock."

Aluminum Aircraft Link "produces high finish without bell-mouthing."

Better finish and alignment maintained on yoke for compressor.

Mild Steel Clevis. Honing was used to correct errors of previous machining and maintain true alignment of the two bearing surfaces of this clevis.

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

Aircraft Valve Tappet Roller. 4-Micro finish.

"Strict alignment maintained between two holes."

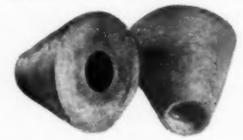
Drill Jig Bushing "Increases sales appeal of product."

"Produced an extremely accurate and glass-like finish."

Airplane Engine Parts accurately honed to a super-smooth finish.

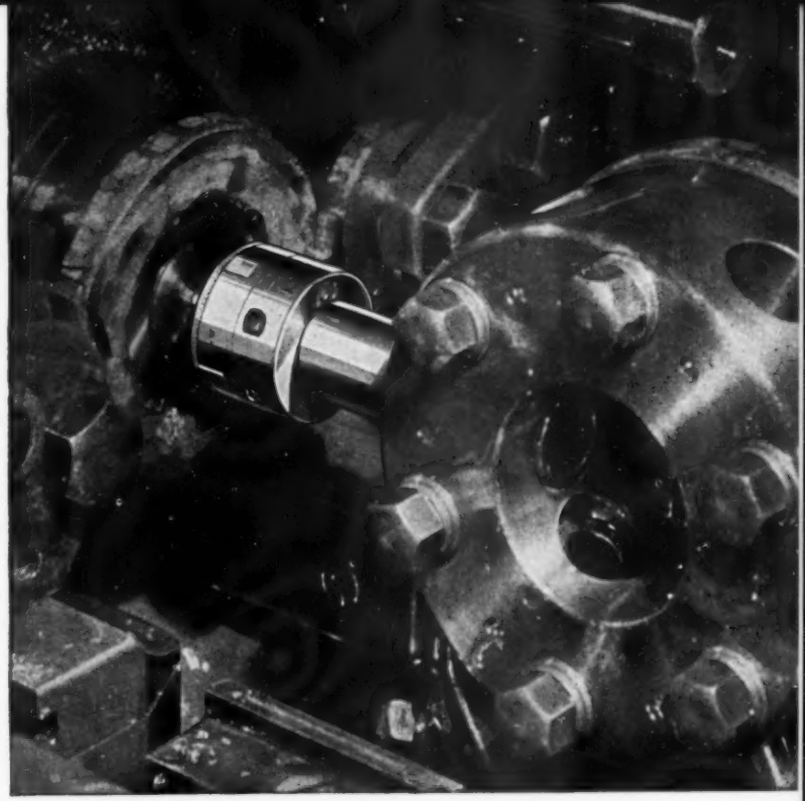
Aviation Hydraulic Cylinder made of Aluminum-Alloy. Improves the quality of the bearing surface. An extremely smooth surface-finish is secured.

Hardened Steel Gears. Honing used to remove any distortion after hardening and to selectively size the gears to uniform diameters.


Cones for Wheel Balancing Machine "Accurately align hones two interrupted surfaces."

SPECIFIED FOR PRECISION SMALL DIAMETER THREADING

EJ-5



Above: A Geometric EJ-5 Die Head on a B & S Automatic, used for cutting minute precision threads in eyeglass screws for the Shuron Optical Company. Mr. R. H. Groh, Manager of the Shuron plant, says, "The Geometric EJ-5 Solid Die Head is perfect for our exacting precision threading requirements. It is made perfect in lead, the chasers are very easy to sharpen and we make 100,000 pieces with one grinding."

How many threads per grind can you get with the best solid die? What accuracy can you depend on? In these days when speed and precision are important — when down time and material waste must be cut to the minimum, it pays to specify die heads of known accuracy and work-producing capacity. The adjustability, accuracy, uniformity and long chaser life of the Geometric Style EJ-5 Solid Adjustable Die Head are making it possible to produce as many as a hundred thousand excellent threads without grinding chasers . . . to cut threads as fine as 100 per inch to Class 3 fits. The tool is equipped with a floating shank of the buffer type as standard.

These are the reasons why more and more manufacturers are using EJ-5 Die Heads to set new production records in the manufacture of precision threads for eyeglasses, business machines, precision instruments, cameras, etc.

Specify them for threads from 1/16" to 3/16" in diameter, in pitches as fine as 100 per inch. Their removable, easily adjusted chasers, their compact design and their uniform accuracy will assure time-, tool-, and material-economy on every small diameter precision threading job. Write for booklet giving full particulars, sizes and specifications. The Geometric Tool Company, New Haven, Conn., U.S.A.

GEOMETRIC

For production-plus
Simplicity of operation
Extreme precision
Versatility

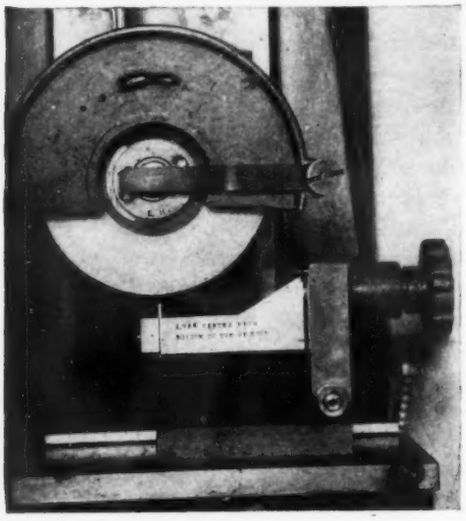
ARTER ROTARY SURFACE GRINDERS

You can depend on Arter Rotary Surface Grinders to improve finish, cut costs, because they are made for fast, close tolerance work.

Arter grinding engineers are always ready to study your grinding problems and tell you how to get maximum precision production.

ARTER GRINDING MACHINE COMPANY

WORCESTER, MASSACHUSETTS • U. S. A.



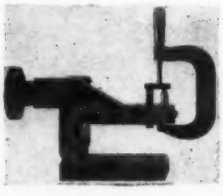
Simplify Grinding Radii and save Valuable Time • • • •

with the NEW C-66 RADIUS DRESSER

1—Faster, more accurate dressing
2—Ability to dress for radii where clearance angle on radius is involved
3—No necessity to remove wheel guard
4—Open and easy to see dressing operation
5—Ability to rotate 180° or 90° in either direction, with stop pins
6—Simple setting of diamond
7—Ability to use several sizes of diamonds and hold them accurately in ground vee
8—Safety feature, hands are kept away from under the wheel

Price $72.50 without diamond, $5.00 extra with diamond

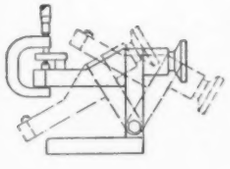
Diamond is set by measuring with micrometer from top of hood to bottom of arm.



Vee Ground in Center of Arm

.013 Male and Female Radius

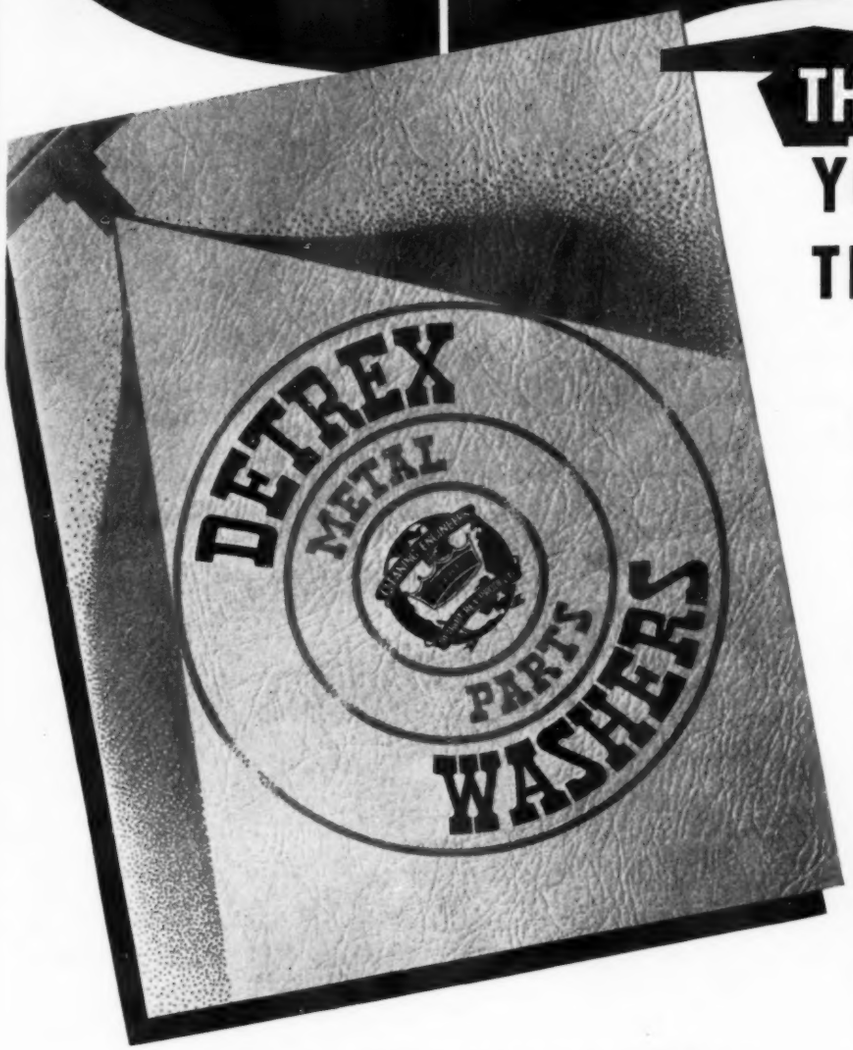
.500 Male and Female Radius



Radius Dresser can be set at clearance angles for turning tools.

SCHULTZ & ANDERSON CO., 109 EDISON PLACE, NEWARK, N. J.

What's New IN METAL PARTS WASHERS



NEW DETREX WASHER BOOK

THIS BOOK IS YOURS FOR THE ASKING

Just off the press . . . an interesting, informative book on Detrex Metal Parts Washers. Illustrated and described is the metal cleaning equipment now in use for many phases of War Production. Indicated is the trend toward the metal parts washers of the future.

Your copy is ready. Write for it on your company letterhead. No charge or obligation.

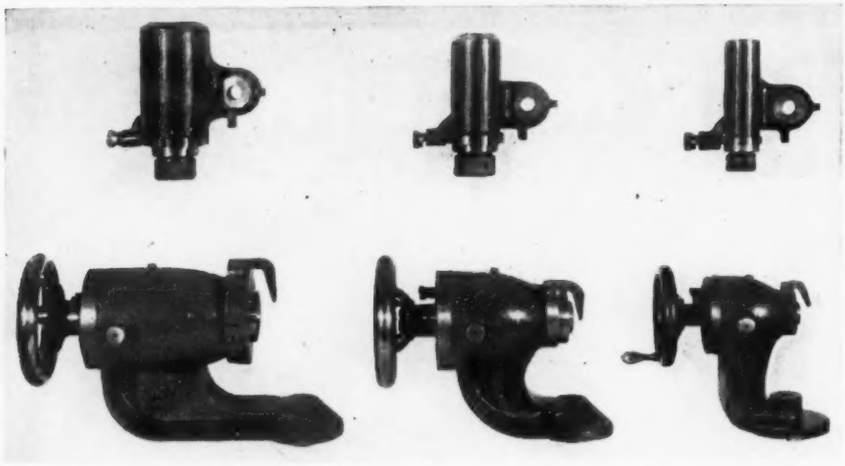
CLEANING ENGINEERS
DETREX
DETROIT REX PRODUCTS

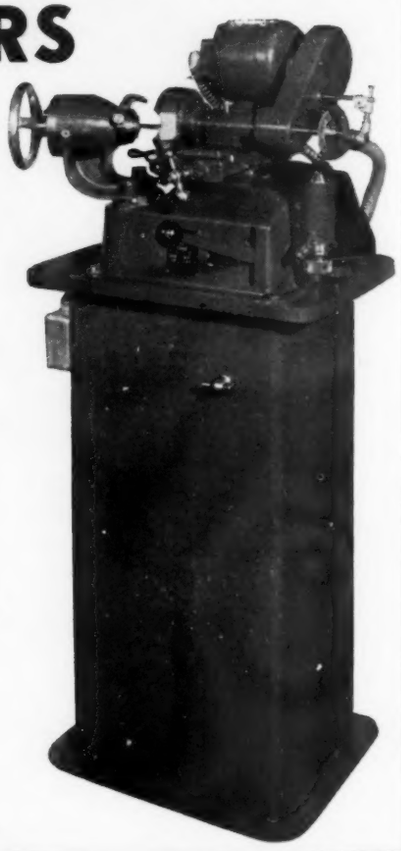
DETROIT REX PRODUCTS COMPANY

13023 HILLVIEW AVENUE • DETROIT, MICHIGAN

Branch Offices In Principal Cities of U. S. A. — In Canada: Canadian Hanson & Van Winkle Co., Ltd., Toronto, Ontario

HYBCO TAP GRINDERS





Three sizes interchangeable heads provide sharpening CHAMFER • FLUTES • SPIRAL POINTS machine screw to 1½" hand taps. Can be arranged for any number of flutes—right or left hand.

Grinders built in three types—Bench—Floor —Floor Type with built in dust collector.

Features belt driven grinding wheel spindle —any type motor to meet your requirements.

Representatives in all important cities

ALL TAPS HELD BY SHANK

Taps can be sharpened after center is destroyed.

HENRY P. BOGGIS & CO., 1279 W. 3rd St., Cleveland, Ohio

VITRIFIED

Keep production on its toes by standardizing on . . .

VITRIFIED GRINDING WHEELS

The Vitrified complete line includes also Silicate, Shellac and Resinoid bonded wheels for conditions requiring high finish, elasticity and heat resistance.

Grinding equipment—for tools or for production requirements—can be brought to higher degrees of precision and speed by standardization of Grinding Wheels.

These objectives can easily be realized through the use of Vitrified Wheels for every grinding operation, because Vitrified offers a complete line of sizes, shapes and types, processed especially for the work to be handled.

. . . Cast Iron, Bronze, etc., can be ground at low cost and efficiency on Vitrified Carborite Wheels. . . . For accurate, fast grinding of steel on a production basis, Vitrified Borite Grinding Wheels increase output and reduce costs.

. . . Also, make Silicate, Shellac and Resinoid Bonded Wheels.

Ask a Vitrified representative to show you how economically you can modernize your grinding operations by standardizing on Vitrified Wheels.

Vitrified Wheels

VITRIFIED WHEEL CO.
WESTFIELD MASS.

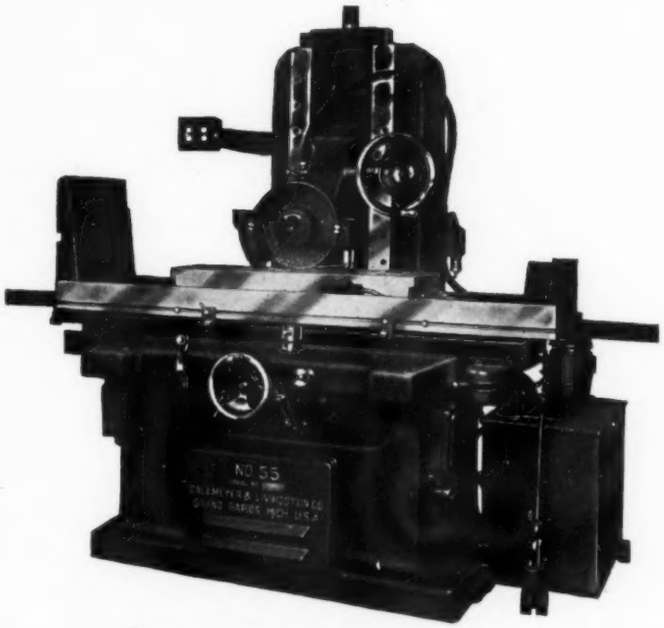
GRAND RAPIDS

Assures the MAXIMUM in

PRODUCTIVITY, PRECISION and CONVENIENCE

Modern in every detail, convenient in control, smooth, fast and quiet, Grand Rapids Grinders offer features which insure sturdiness, ruggedness and flexibility. High accuracy in long, hard service can be depended on. More than thirty-five years experience in the development of surface grinding machines of highest quality and precision is behind the complete line of Grand Rapids machines.

Many opportunities to meet the exacting needs of tool room and production are available from Grand Rapids. It will pay you to investigate.

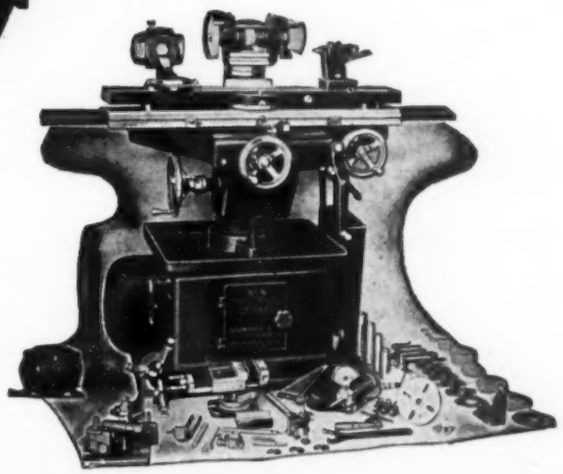


HIGH SPEED PRECISION TOOL ROOM GRINDERS

Grand Rapids Precision Type Hydraulic Feed Surface Grinders, for tool room or production grinding, can be depended on for producing work to the highest commercial standards of accuracy.

Features include infinitely variable table speeds, vernier vertical wheel adjustment and rigid, one-piece column and base. Hydraulic feed contributes to smoother work. Two spindle speeds make it possible to save and use worn wheels.

These machines are fully described in Bulletin GL 100—available promptly on request.



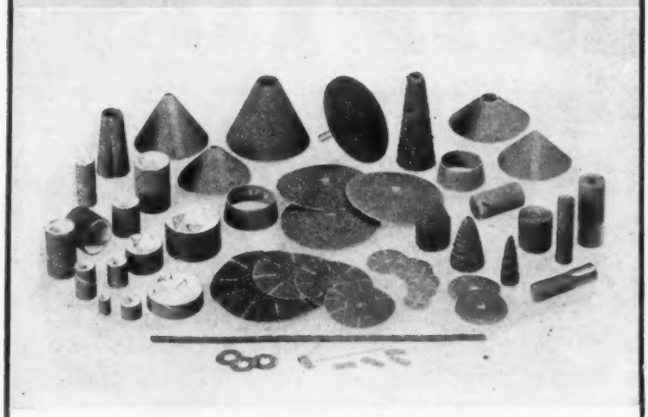
TOOL AND CUTTER GRINDERS

These universal machines provide facilities for grinding gear cutters, formed cutters, angle cutters, face mills, end mills, side mills, spiral and plain milling cutters, thread chasing tools, reamers, hobbs, etc. They are capable of performing cylindrical, internal, surface and precision tool grinding. The outstanding versatility of Grand Rapids Tool and Cutter Grinders is combined with a convenience in operation which makes it possible to maintain a wide range of tools in perfectly sharpened condition quickly and easily. Investigate these Grand Rapids machines as a means of stepping up your production and making your tools last longer. Write for a copy of Bulletin 3-1-41.

GALLMEYER & LIVINGSTON CO.

330 STRAIGHT AVE. S.W. GRAND RAPIDS, MICHIGAN

NORTON ABRASIVES



"IN PERSON"

At Booth C-141

NATIONAL METAL EXPOSITION

Cleveland

. . . these ready-to-use abrasive specialties of

METALITE CLOTH

▲

At the business end of portable and other tools they have been playing a fine part in speeding the war effort.

Operations such as these are done in seconds instead of minutes:

Sanding holes
Polishing dies
Knocking off flashes
Converting edges to radii
Finishing odd shapes, internal or external

on Metal and Plastics

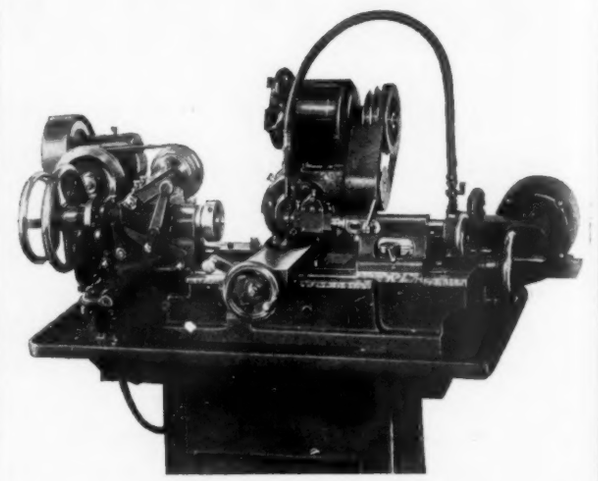
▲

See Them In Operation
Try Them Yourself

We're here to serve and show you.

N. B.—*Nothing that we can say is one-tenth as illuminating as seeing these abrasives in action—comparing their speed and amazingly uniform output with those of former hand methods.*
No new tools are needed; they're in your plant now.

BEHR-MANNING
(DIVISION OF NORTON COMPANY)
TROY, N. Y.
DEPENDABLE ABRASIVES SINCE 1872

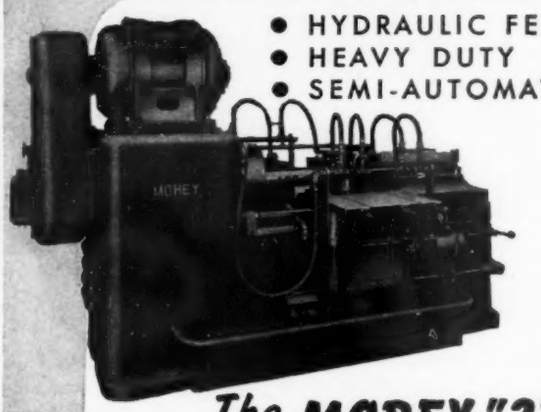


WALTHAM THREAD MILLER
WITH 3 MOTOR DRIVE

A semi-automatic machine for production or tool room service. It is best adapted for work 2" in diameter or smaller. Special equipment for short multiple cutter work with cam shaft control can be furnished. A cutter head for internal work can also be supplied.

WALTHAM MACHINE WORKS
HIGH STREET WALTHAM, MASS.

Suitable for 105 M.M. to 155 M.M. Shells



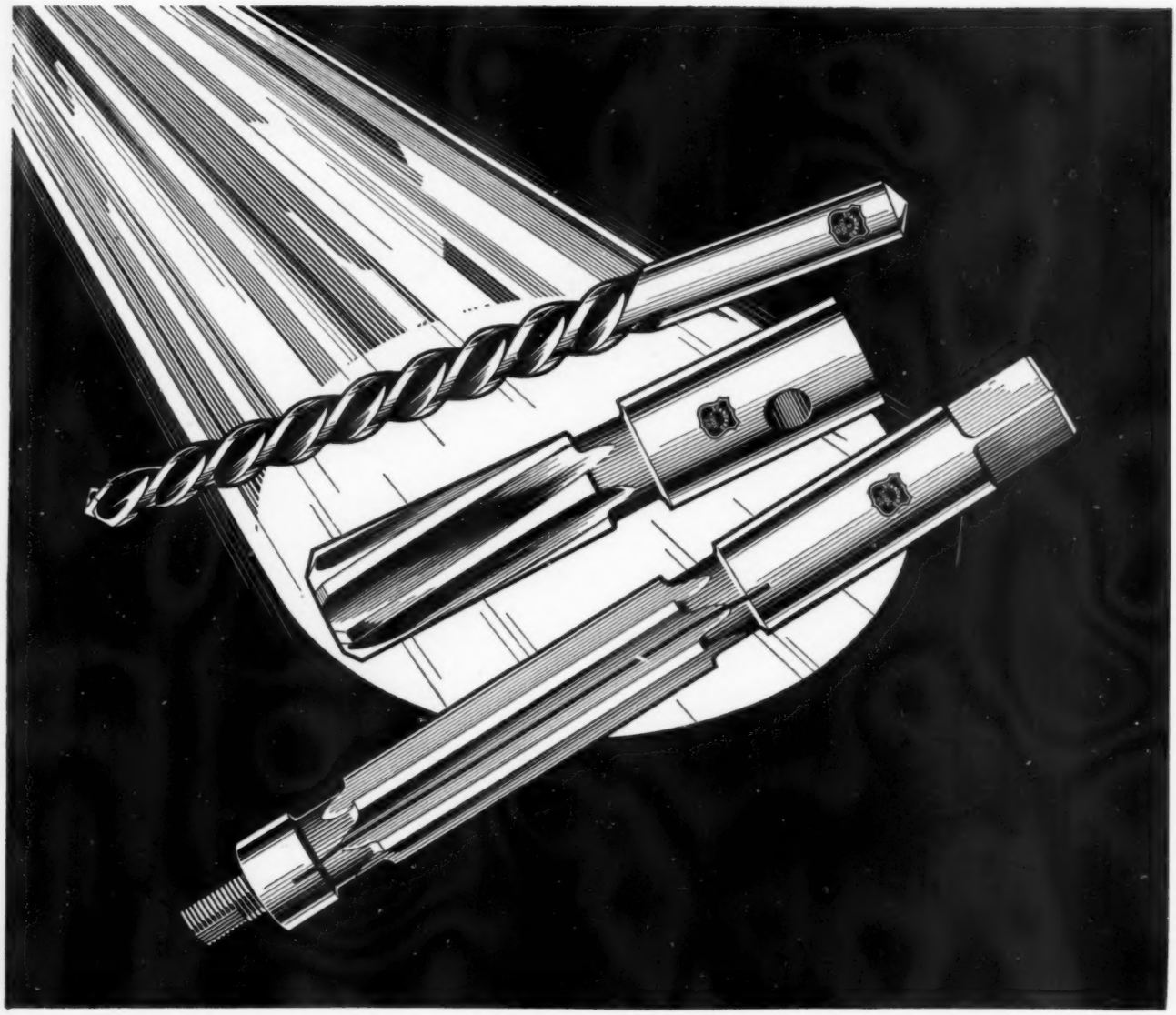
- HYDRAULIC FEED
- HEAVY DUTY
- SEMI-AUTOMATIC

The MOREY "27" SHELL LATHE

Timken Tapered Roller Bearings for Main Spindle—All Others Anti-Friction

The HYDRAULIC FEED insures an almost effortless operation. Rigid enough to use carbide tools to their full capacity—entirely self-contained—no outside or auxiliary equipment required! Details in Circular 715—ask for it.

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

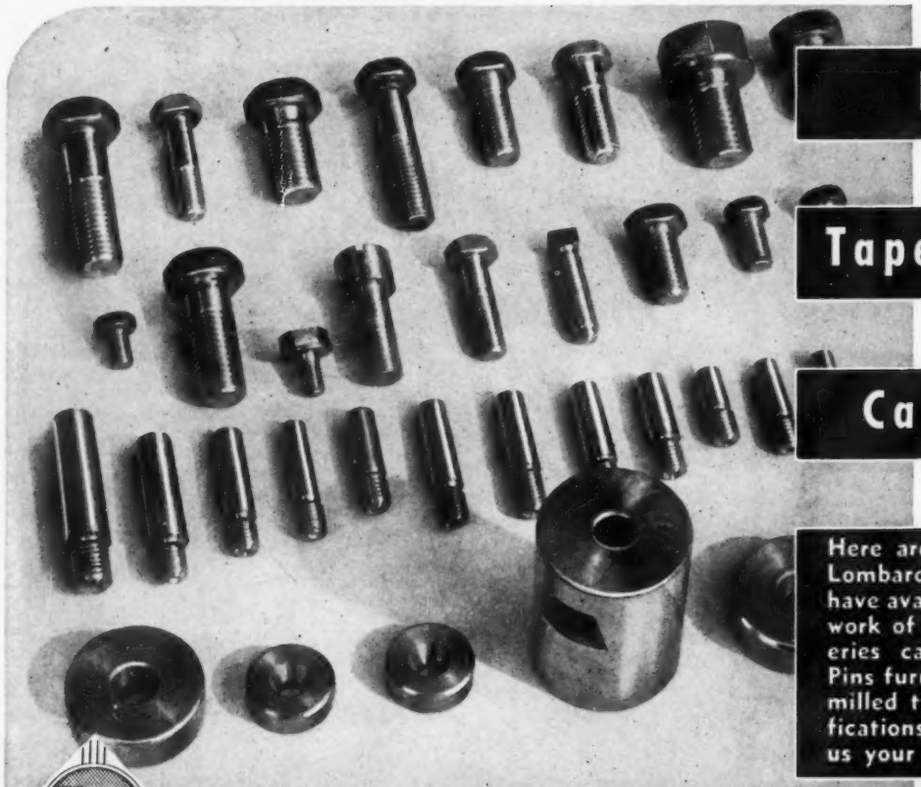


Twist Drills · Milling Cutters
Taps · Dies · Reamers · Drill Chucks
Wheel Dressers · Special Tools

THE STANDARD TOOL CO.

CLEVELAND

NEW YORK • DETROIT • CHICAGO



BOLTS

Taper Dowel Pins

Cartridge Dies

Here are representative samples of Lombard precision manufacture. We have available capacity for additional work of this nature and quick deliveries can be made. Taper Dowel Pins furnished with either ground or milled threads. Sizes to your specifications. Send us a print — or tell us your problem.

LOMBARD GOVERNOR CORPORATION
200 MAIN ST., ASHLAND, MASS., U. S. A.

REID

SURFACE GRINDERS

Catalog on request

Model 2-C. Hand-Feed

A convenient machine tool, with all manual controls placed within easy reach. Bearing surfaces thoroughly protected by telescoping apron, attached to column. Work capacity up to 6x18x14 in. Table size 51x8 in. Spindle speed 3500 rpm.

Model 2-B. Automatic Feed

A precision machine tool, with reversible motor-driven spindle. Oil rollers on table and cross slides for proper lubrication. Chain actuated table instead of rack and pinion movement. Work capacity 6x18x14 in. Table size 51x8 in. Spindle speed 3500 rpm. Extra height may be had on standard machines.

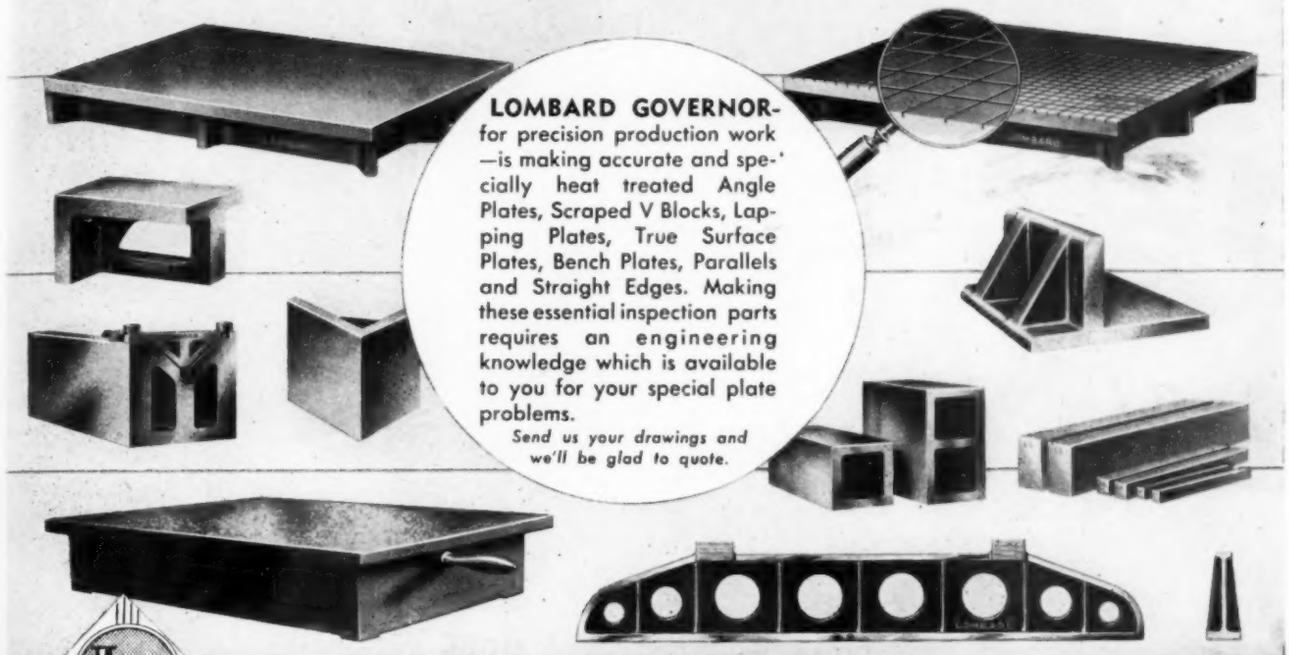
H. LEACH MACHINERY CO.

367 CHARLES ST., PROVIDENCE, R. I.

Sole Agents

DISTRIBUTORS IN KEY CITIES

Have You a Special Plate Problem?



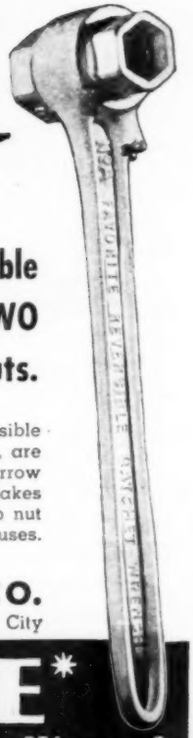
LOMBARD GOVERNOR- for precision production work —is making accurate and specially heat treated Angle Plates, Scraped V Blocks, Lapping Plates, True Surface Plates, Bench Plates, Parallels and Straight Edges. Making these essential inspection parts requires an engineering knowledge which is available to you for your special plate problems.

Send us your drawings and we'll be glad to quote.

LOMBARD GOVERNOR CORPORATION
200 MAIN ST., ASHLAND, MASS., U. S. A.

THE *only* WRENCH WITH THIS IMPORTANT FEATURE

Each removable head fits TWO sizes of nuts.



Speed up production with FAVORITE Reversible Ratchet Wrenches. They fit over long studs, are instantly reversible, can be used in narrow spaces. Three handle sizes... each handle takes five different heads . . . each head fits two nut sizes. Carried by leading mill supply houses. Write for circular and prices.

GREENE, TWEED & CO.
Bronx Blvd. at 238th Street, New York City

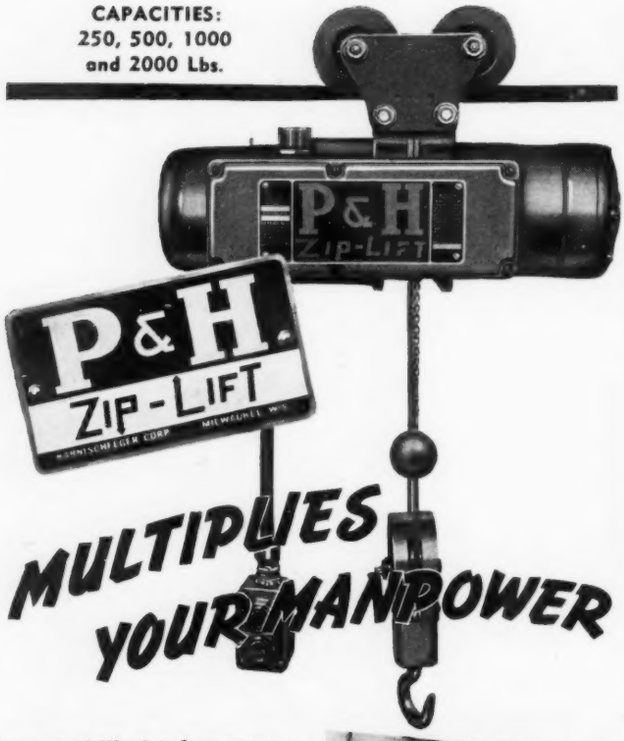
FAVORITE* *Reversible Ratchet Wrench*

Blast 'em **with the Diamond-U** *Blow Gun!*

Here's the Blow Gun with which the operator can apply the softest puff of air or full airline pressure blast to his work, with POSITIVE CONTROL. Beautifully balanced, feather-light, it also has the enduring stamina for war production lines. A long time favorite in the automotive field, the "212" is winning "E"s in aircraft and other plants the country over. It's available only on an A1-J or better rating. Order from your Jobber...and buy War Bonds!

SERVICE EQUIPMENT COMPANY
MANUFACTURERS...SOUTH GATE, CALIFORNIA

CAPACITIES:
250, 500, 1000
and 2000 Lbs.

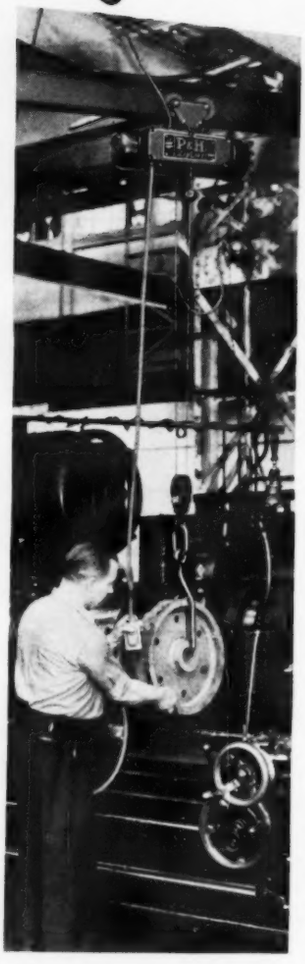


MULTIPLIES YOUR MANPOWER

Saves Skilled Labor with Zip-Lifts. Machine operators can handle and position their work more quickly and accurately. Both men and machines can produce more.

Speeds Production by keeping materials moving along at double-quick time. "Thru-the-Air" handling with a Zip-Lift eliminates aisle congestion and prevents accidents.

Relieves Worker Fatigue. One man with only one hand on the magnetic push-button control, can operate this hoist leaving one hand free to guide the load.



LOOK WHAT YOU GET IN A ZIP-LIFT

Full magnetic push-button control, real wire non-spinning cables, three-way interchangeable mounting, safety type limit switch, double safety brakes, all-weather fully-enclosed housing. These and many other features make Zip-Lift your best buy in electric hoists. Literature on request.

Awarded the Navy "E" for excellence in war production, P&H displays it also as a pledge of future effort.

General Office: 4514 West National Avenue, Milwaukee, Wisconsin

HARNISCHFEGER CORPORATION

HOISTS · WELDING ELECTRODES · MOTORS · P&H · EXCAVATORS · ELECTRIC CRANES · ARC WELDERS

Flexible Shaft Equipment

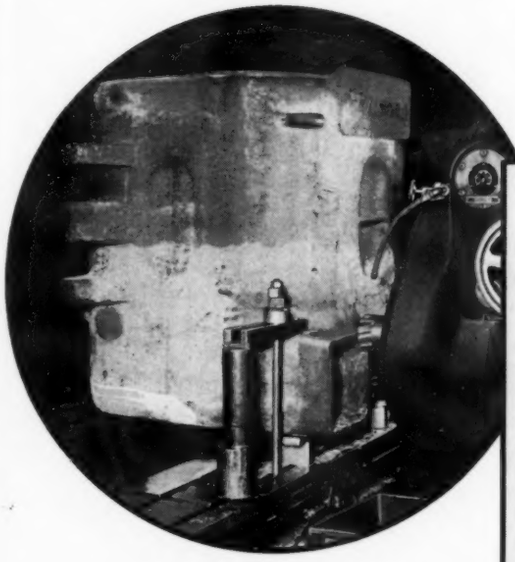
MORE VERSATILE MACHINES for MORE PROFITABLE WORK

Heavy duty grinding is only *one of many* jobs Haskins Flexible Shaft Equipment will do for you at less cost per man and machine hour. Haskins makes 30 different kinds of equipment—but *each* kind will do *many* kinds of work. See how *you* can apply flexible shaft equipment to more jobs—more profitably. Send for Catalog 45. You'll find it full of valuable information covering grinding, sanding, wire brushing, polishing and rotary filing operations. R. G. Haskins Company, 2760 W. Flournoy St., Chicago, Illinois.

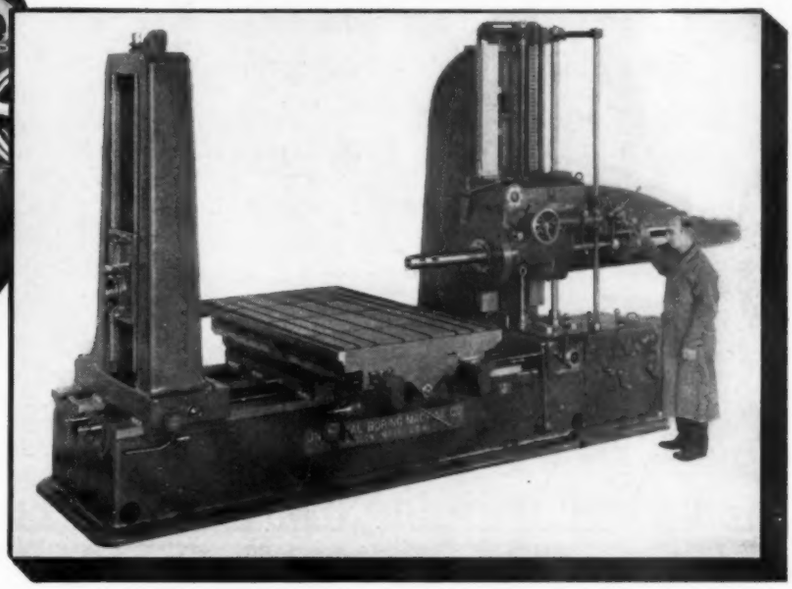
HASKINS *Versatile* FLEXIBLE SHAFT EQUIPMENT

HEAVY WORK HEAVY CUTS—

— TO CLOSEST TOLERANCES ON THE 4-INCH UNIVERSAL BORING MACHINE



MILLING DIESEL ENGINE FRAME FOR SWITCHING LOCOMOTIVE



1. Three Bed Ways — span 44 inches.
2. Table Semi-Box design, heavily ribbed.
3. Motor mounted directly on base.
4. Saddle lead screw nut mounted between guiding ways.
5. Centralized right hand control.
6. Heavy duty type — heaviest 4" spindle machine built.
7. One shot lubrication for head; also for saddle and table assembly.

Pile a good, heavy job on the 4" Universal, then take a husky cut. This will prove the stamina of the machine — especially when the tolerances are close.

A manufacturer of motors for diesel-electric switching engines uses a 4" Universal for face-milling around the air ducts, gear case lugs and brush holder pads on the motor frame.

Full advantage is taken of the Universal TRI-WAY Bed on jobs like this — the load is well distributed — alignment is assured — the work may be moved easily for setting up — or locked securely when under cut.

UNIVERSAL

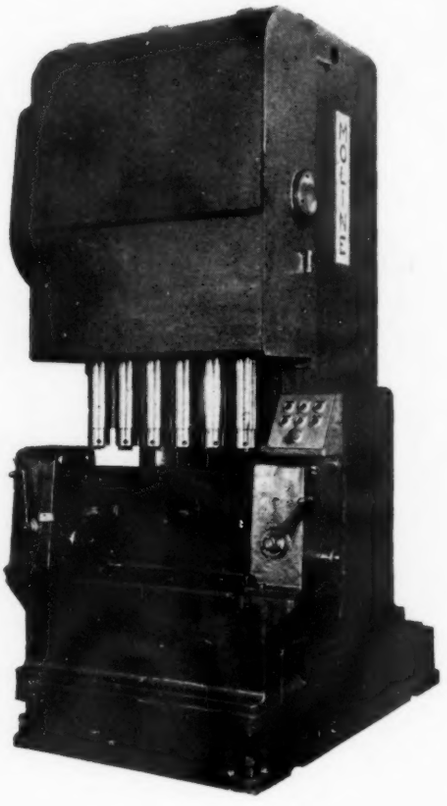
BORING MACHINE COMPANY · HUDSON, MASS., U. S. A.

On the INDUSTRIAL FRONT

★

Moline No. 116FB Precision Boring Machines on the industrial front finish bore the cylinders of internal combustion engines so that our armed forces on the fighting front will have plenty of high quality power driven equipment.

★



MOLINE TOOL COMPANY

Moline, Illinois "Holehog" Established 1901

CARD MACHINE SCREW TAPS

The CARD Quality

Buy them and put them to work

Carbon and High Speed Steel

Manufactured in Regular Type in 2, 3 or 4 flutes according tc size and in Spiral Pointed Type in 2 flutes.

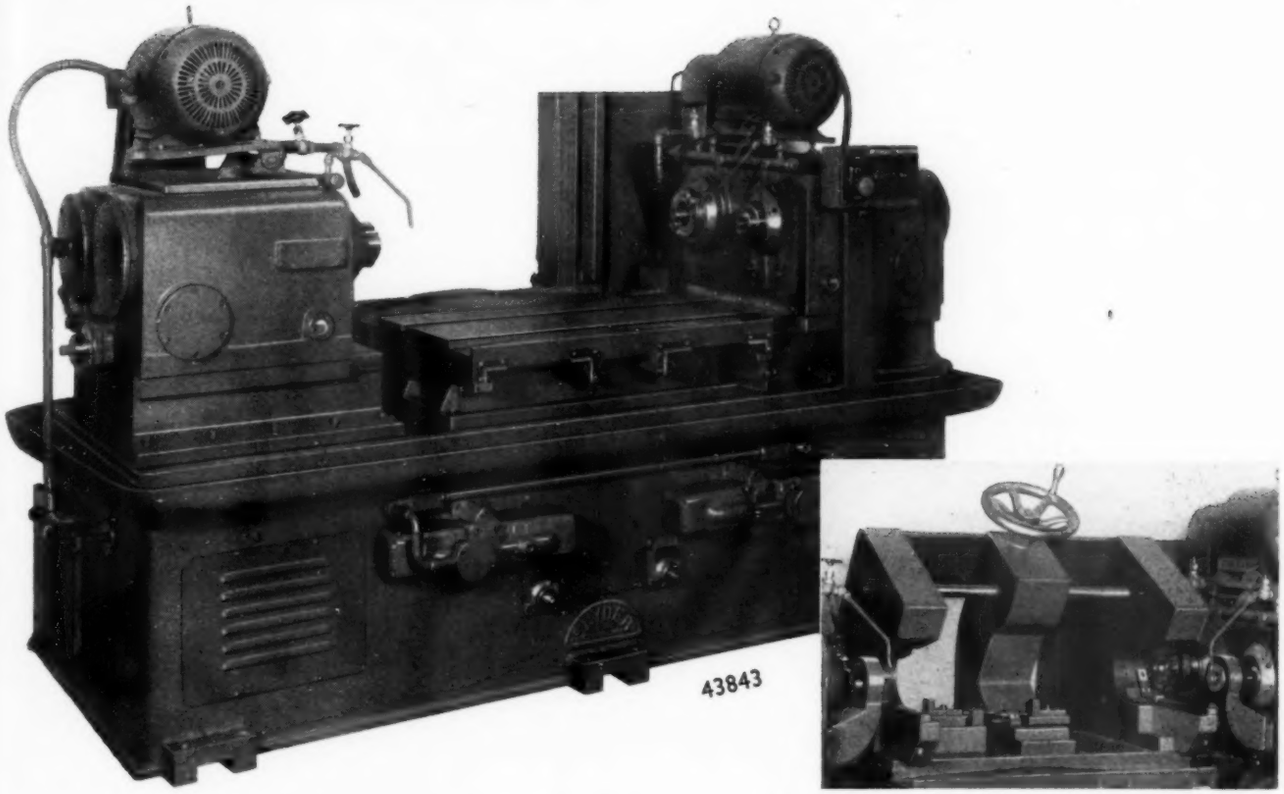
Both Regular and Spiral Pointed Types are furnished with National form of thread. Regular Type furnished in taper, plug or bottoming styles; Spiral Pointed furnished in plug style only. Furnished in Carbon, High Speed cut and High Speed Ground Thread.

Put Card Machine Screw Taps to work and their performance will convince you of their economy. You'll find sizes listed in the Card Catalog No. 34, page 32-37. Circular covering recommended uses available on request.

Leading dealers carry the Card line

S. W. CARD MANUFACTURING CO.
Mansfield, Mass., U. S. A.
DIVISION OF UNION TWIST DRILL CO

STORES: New York: 61 Reade St., Chicago: 11 S. Clinton St.
Detroit: 6540 Antoine St., San Francisco: 121 Second St.
Seattle: 568 First Avenue, South
Los Angeles: 524 East Fourth Street



Heavy Duty, Double End Facing and Centering Machine

This heavy duty, double end facing and centering machine, is available in *standard sizes* that will take work lengths ranging from 12″ to 20″; 20″ to 28″; 28″ to 36″ and 34″ to 44″.

It consists of two units, each equipped for milling and centering. The worm driven milling spindle is provided with a No. 50 National Machine Tool Builders' standard taper. The quill type centering spindle is ball bearing mounted and has hydraulic feed. All moving parts in the unit are lubricated by an oil pump from an inbuilt reservoir.

The cutter range for milling is 3″ to 8″ and center drills may range from 5/16″ to ¾″. The machine is hydraulically operated and electrically controlled.

The work cycle is as follows:

With the part clamped in the fixture, fixture and slide automatically feed the work between the two milling cutters. When the work piece is faced to length, the slide returns to the original loading position—opposite the centering drills. These are then fed into the work and their return to starting position completes the cycle.

The fixture shown in the inset is for a shaft with a diameter of 4 1/4″ at one end and a flange of 6″ diameter on the opposite end.

The welded steel base of the machine encloses the hydraulic equipment, piping, etc., and adjustable trip-dogs which are set up at the beginning of the job for the respective work lengths. The coolant is contained in an auxiliary tank in the rear of the machine. The cover of this tank is a removable chip tray.

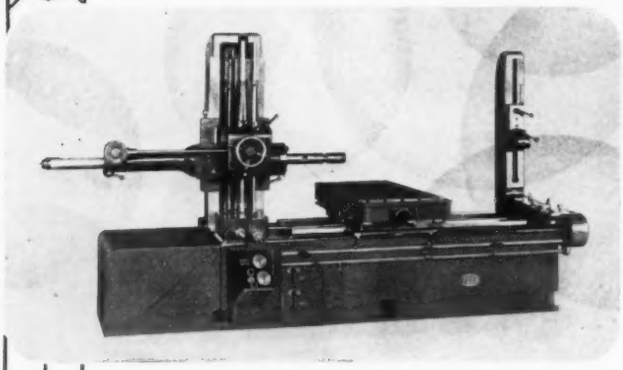
This is a typical example of a Snyder special machine designed and built specifically for high production at low unit cost. If production is your problem, we invite your inquiries.

SNYDER
TOOL & ENGINEERING CO.
3400 E. Lafayette Ave. • Detroit

designers and builders of machinery for HIGH *production at* LOW *unit cost*

New Advanced Design

Yoder No. 3A HORIZONTAL BORING MILL



YODER POWER TOUCH CONTROL...

A convenient central control station. Versatile in its quick starting and stopping, speed adjustment without stopping and correct speed setting.

YODER POWER FLOW DRIVE...

The full advantage of a D.C. Drive (from A.C. power source) such as rapid acceleration up to predetermined speed settings, quick shockless stops and starts, infinite speed adjustments.

YODER PLUS OTHER FEATURES...

A *two-speed rapid traverse* facilitates inching up to the work at a slow rate and at a high rate when considerable travel must be made. *Main drive* for spindle is direct from a motor, while the feed drive is from another motor through positive clutch drive.

Heavy multiple thread gear on the spindle drive eliminates all noise and chatter. All drive shafts, drive and feed gears, are of the best alloy steels obtainable, mounted on anti-friction bearings and provided with oil pump flood lubrication. And many more desirable features! Write for the late bulletin for full description.

Buy War Bonds

The ENGINEERING YODER MANUFACTURING SALES COMPANY
CLEVELAND, OHIO

Offering you *practical design methods and procedures* actually used in engineering design departments

Every design engineer has always wished for a compilation of design standards and methods of design procedure. Many engineering departments have gathered material of this kind which they call their standards manual.

The Editors of *Product Engineering* from the very first issue of the magazine gathered, compiled, checked and edited such reference sheets.

Now they have brought them all together in authoritative form for the use of all design engineers.

Just Published

HANDBOOK OF MECHANICAL DESIGN

By GEORGE F. NORDENHOLT
Editor of *Product Engineering*
JOSEPH KERR
Managing Editor of *Product Engineering*
and JOHN SASSO
Associate Editor of *Product Engineering*

285 pages, 8 x 11, 555 illustrations, $4.00

MAKE use of the experience of other engineers in your designing of the details of industrial machinery and equipment of all types. Save time and effort by using this handbook of standard design data right at your drafting board.

For instance, if you wish to design a seal for a shaft, all you have to do is to turn to the six-page presentation on seals and there you will find 40 examples of sealing. This applies also to spring design. In the chapter on spring design you will find many quick methods of calculating springs.

Everything is boiled down to essentials and presented in concise, quick-use nomograms, charts, tables, check-lists, etc. Calculations, properties of materials, production factors of design, and similar material is well represented, and other chapters give a great many basic designs for fastenings, mechanisms, drives, controls, etc., readily adaptable to a wide number of applications. Most of the material has appeared in *Product Engineering* as special features of great popularity—here condensed, re-edited, brought up to date, and gathered together in convenient form for practical use.

Eight chapters packed with priceless information

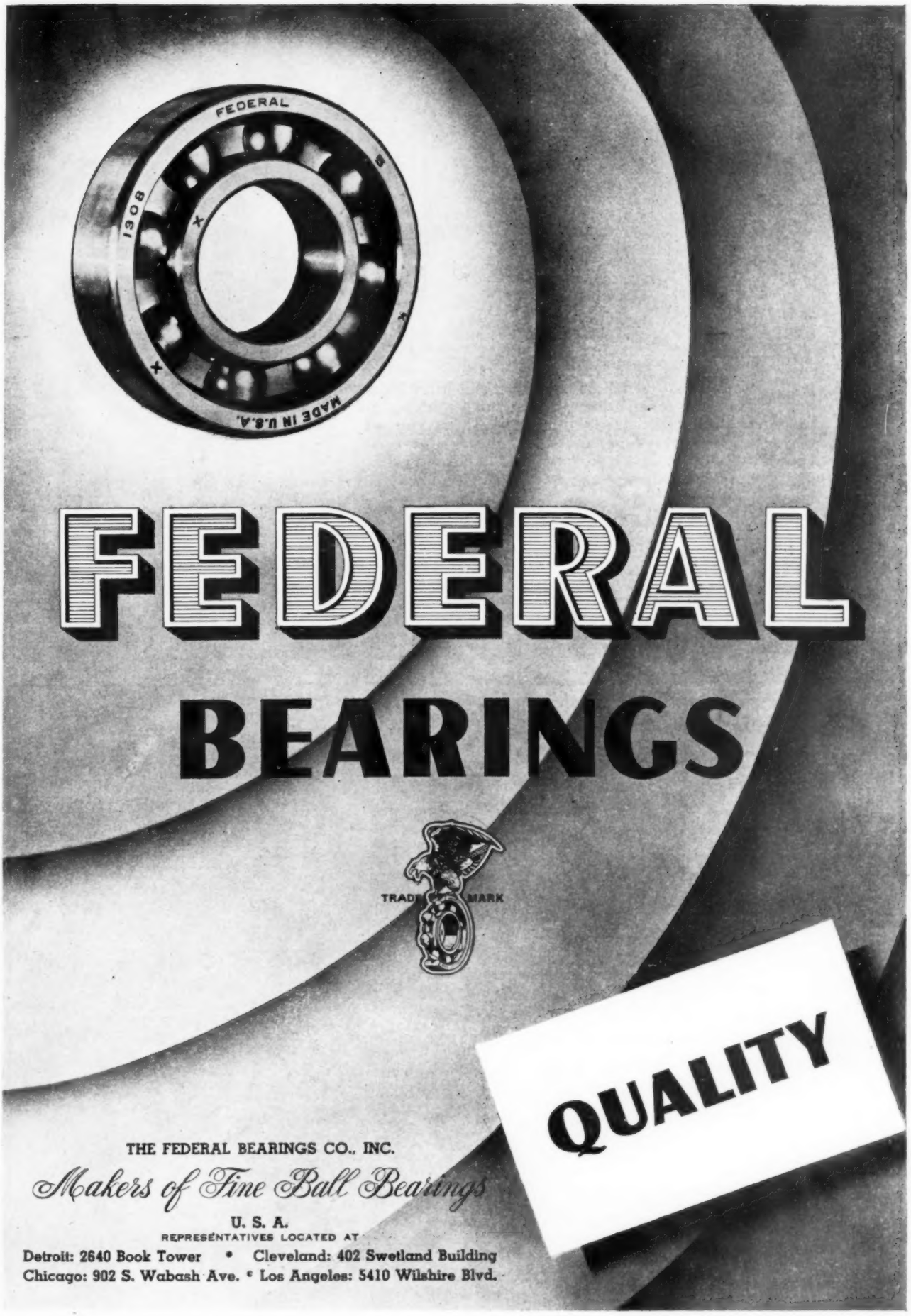
1. Charts and Tables
2. Materials
3. Beams and Structures
4. Latches, Locks and Fastenings
5. Springs
6. Power Transmission Elements and Mechanisms
7. Drives and Controls
8. Design Data on Production Methods

SEND THIS COUPON TO SEE BOOK 10 DAYS FREE

McGraw-Hill Book Co.
330 W. 42nd St., N. Y. C.

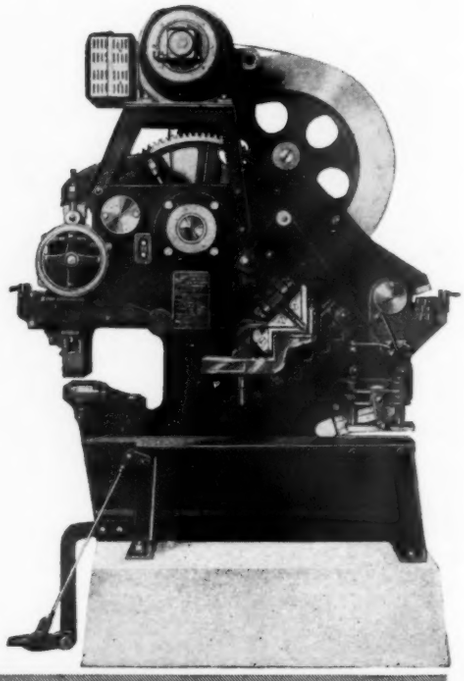
Send me Nordenholt, Kerr and Sasso's Handbook of Mechanical Design for 10 days' examination on approval. In 10 days I will send $4.00, plus few cents postage, or return book postpaid. (We pay postage on orders accompanied by remittances.)

Name .....
Address .....
City and State .....
Position .....
Company ..... A. 10-1-42


FEDERAL
1308
MADE IN U.S.A.
FEDERAL
BEARINGS
TRADE MARK
QUALITY
THE FEDERAL BEARINGS CO., INC.
Makers of Fine Ball Bearings
U. S. A.
REPRESENTATIVES LOCATED AT
Detroit: 2640 Book Tower • Cleveland: 402 Swetland Building
Chicago: 902 S. Wabash Ave. • Los Angeles: 5410 Wilshire Blvd.

Cramming More Production INTO EVERY HOUR

PUNCHING . . SHEARING
SLITTING . . COPING . . NOTCHING
of
ANGLES . . TEES . . CHANNELS
I-BEAMS . . ROUNDS . . SQUARES
FLATS . . PLATES



The operator at the controls of a Buffalo Universal Iron Worker is virtually a foreman with a whole crew of metal fabricators. Swiftly, accurately the most difficult work moves along on schedule—keeps production lines humming. These rugged, Buffalo-pioneered tools are today meeting Industry's severest assignments without let-up—and with 24-hour-a-day dependability.

BUFFALO FORGE COMPANY
448 BROADWAY BUFFALO, N. Y.

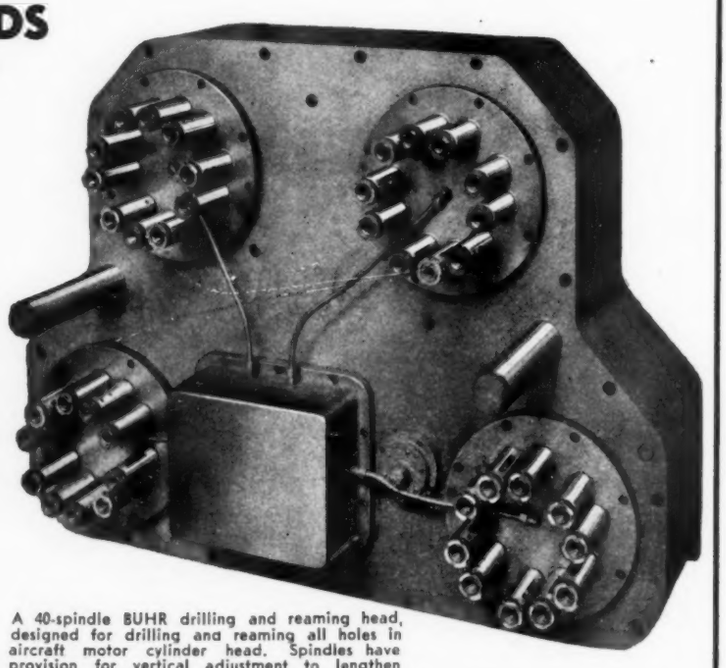
Canadian Blower & Forge Co., Ltd.
Kitchener, Ont.

"Buffalo" UNIVERSAL IRON WORKER

Buhr DRILL HEADS SIMILAR TO THIS ONE,

ARE SPEEDING PRODUCTION IN VITAL WAR PLANTS

Here is but one example of the specialized engineering incorporated in BUHR - designed drill heads, now being used in the production of aircraft and armament. Want similar applications, so as to speed your work? Then send us your blueprints . . . . we'll make suggestions and recommendations on the use of BUHR-engineering and equipment.



A 40-spindle BUHR drilling and reaming head, designed for drilling and reaming all holes in aircraft motor cylinder head. Spindles have provision for vertical adjustment to lengthen drills. Oil pump gives positive lubrication at all times.

BUHR MACHINE TOOL COMPANY • ANN ARBOR, MICH.
Specialists in Multiple Spindle Drilling, Boring, Reaming, Tapping Equipment

No Stowaways in

(T-J) HYDRAULIC CYLINDERS!

Pressure X cylinder area minus pressure loss due to friction = Performance

Right in here is where the stowaway hides out if you've got one in your hydraulic cylinders. He chisels down on efficiency and lowers the useful work done.

T-J hydraulic cylinders have no stowaways. Their high mechanical efficiencies are actual being initially obtained and thereafter maintained in this manner.

The cylinder body is honed to accurate concentricity and straightness. It is perfectly aligned with the rod bearing. Pistons are of one-piece extra-length construction for better rod alignment. Pistons have hydraulic packing to be effectively sealed with minimum friction. The hydraulically packed piston rod is also supported by a substantial guide bushing.

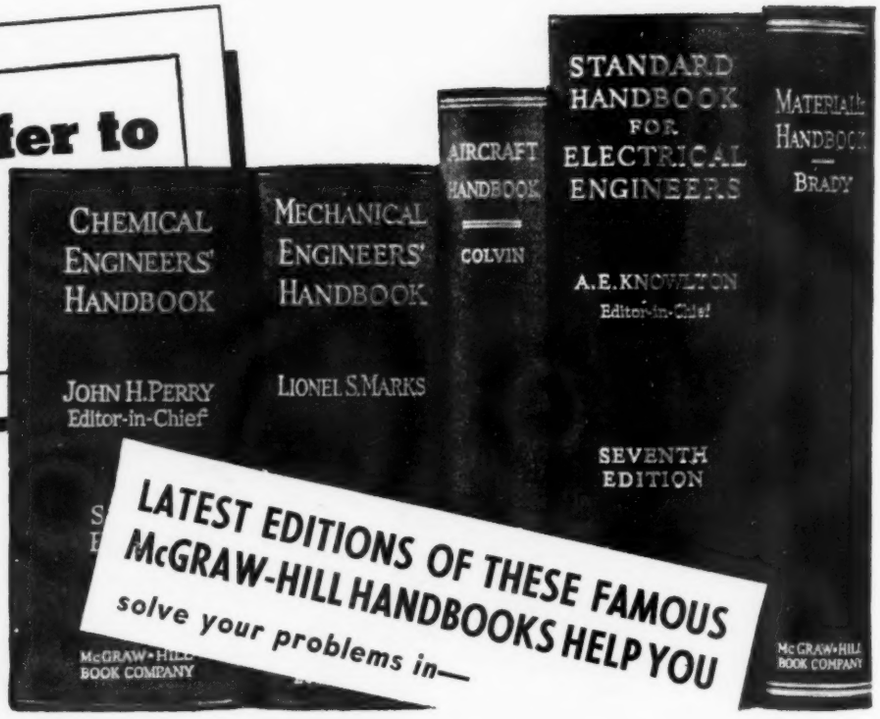
T-J hydraulic cylinders are available in many sizes and styles.

Send for . . .

catalog H-40-A which presents data on construction, sizes, capacities, mountings and applications.

THE TOMKINS-JOHNSON CO., Jackson, Michigan, U. S. A.

Special Offer to TECHNICAL MEN:



Use any or all 5 of these great new handbooks

10 DAYS FREE

- *aircraft maintenance work*
- *chemical engineering*
- *electrical engineering*
- *mechanical engineering*
- *materials selection*

1. STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS

New Seventh Edition. The great standard reference work of all in the electrical engineering profession or whose work in industry or engineering touches this field. Presents a handy-reference compilation of practical, usable data from all fields of electrical engineering practice, plus the most frequently required fundamental theory, units, and systems of measurement, made dependable by the work of more than 100 authorities. Whole sections have been added; others rewritten or fully revised; new format incorporating larger page size, large type, larger diagrams; improved from cover to cover to continue the Standard as the one indispensable reference tool of the electrical engineering profession. *Prepared by a staff of specialists. Archer E. Knowlton, Editor-in-Chief, Associate Editor for Engineering,* Electrical World. *2303 pp., 6x9, 1700 illustrations, 600 tables, thumb-indexed, $8.00.*

2. MECHANICAL ENGINEERS' HANDBOOK

New Fourth Edition. An all-round, up-to-the-minute tool for engineers. Gives you the thousands of facts in all branches of mechanical engineering that you need in your work, expertly treated and arranged for quick use. Covers every branch of the field, from aeronautics to mechanical refrigeration, from power generation to welding—with a profusion of concise descriptions of newest developments and trends, advances in practice, in theory, in systematization of machine elements, formulas, methods, tables, diagrams, fundamentals—all the most frequently needed standard data and practice. Here is the sort of material you might accumulate in years of experience and many hours of reading professional books and articles—yours, ready for use, in one convenient volume. *Edited by Lionel S. Marks, Gordon McKay Professor of Mechanical Engineering, Emeritus, Harvard Univ. 2276 pp., 1700 illustrations, 800 tables, thumb-indexed, $7.00.*

3. CHEMICAL ENGINEERS' HANDBOOK

New Second Edition. A complete chemical engineering library in one volume—now thoroughly revised to meet current and pressing needs. Brings you the data needed in routine problems of design and practice and in investigation of special problems or branches of work. Concise descriptions and working fundamentals of processes and equipment are supplemented by a profusion of comprehensive formulas and equations, charts, tables, data, schematic diagrams, etc.—everything carefully selected for its practical application, arranged for quick reference to the essentials required by men in practical contact with chemical engineering problems of all types. *Prepared by a staff of specialists, John H. Perry, Editor; E. I. du Pont de Nemours & Co. 3029 pp., 1300 illustrations, 1000 tables, $10.00.*

4. MATERIALS HANDBOOK

New Fourth Edition. An encyclopedia for purchasing agents, engineers, executives, and foremen. Presents the most important facts relating to a number of materials to enable you to make quick comparison, avoid checking many sources and remote possibilities, and quickly get a working knowledge of the best materials suited to a specific purpose. Covers 5000 materials—metals, alloys, organic materials, industrial chemicals, paints and finishing materials, molding materials, minerals, woods, and many others—with information on chief characteristics, comparative data, sources, substitutes, adulterants, and uses. A short-cut to accurate, essential facts needed in the selection and specification of materials. *By George S. Brady, formerly Managing Editor,* Product Engineering. *591 pp., 6x9, $5.00.*

5. AIRCRAFT HANDBOOK

New Fifth Edition. A comprehensive and authoritative manual for all concerned with aircraft maintenance, and others who need a detailed working knowledge of airplane engines and accessories. In a fully-illustrated, easy-to-understand treatment, its 20 sections present a wealth of practical information on everything from construction details of all types of engines to suggestions on the care of pontoons, from instructions for the complete assembly of engines to methods of splicing wires. Concentrates on the maintenance of engines and their accessories, adjustable propellers, and the most used airplane instruments. Includes data on landing gears, floats, and care of planes at terminals. Gives everything necessary to the intelligent performance of inspection, servicing, and repair work. *By Fred H. Colvin, Editor Emeritus,* American Machinist, *784 pp., 5½x8, 621 illustrations, 112 tables, $5.00.*

CHECK the books you want on this coupon . . .

McGRAW-HILL EXAMINATION COUPON

McGraw-Hill Book Co., Inc., 330 W. 42nd Street, New York

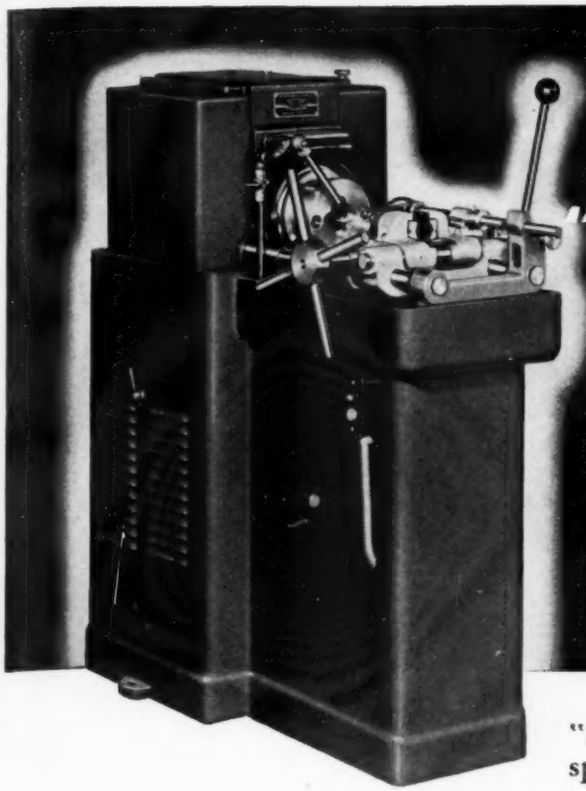
Send me the books checked below for 10 days' examination on approval. In 10 days I will pay for the books, plus few cents postage, or return them postpaid. (We pay postage if you remit with order.)

- ☐ Standard Handbook for Electrical Engineers, $8.00
- ☐ Perry—Chemical Engineers' Handbook, $10.00
- ☐ Marks—Mechanical Engineers' Handbook, $7.00
- ☐ Colvin—Aircraft Handbook, $5.00
- ☐ Brady—Materials Handbook, $5.00

Name .....

Address ..... Position .....

City and State ..... Company ..... F.A. 10-1-42

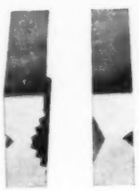


OSTER "RAPIDUCTION JUNIOR"

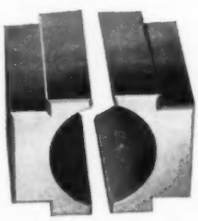
. . . for Fast, Accurate Threading of Bolts, Rods, Studs, Pipe, and Nipples

"RAPIDUCTION JUNIOR" is a low cost, high speed, threading machine. It has wide application on standard and special threading jobs. Its revolving, self-closing die-head and open-type vise facilitate the handling of stock in and out of the machine.

Here's a sample of its *per hour* performance: 500—3/8" bolts or studs of screw stock threaded one inch on one end every hour.



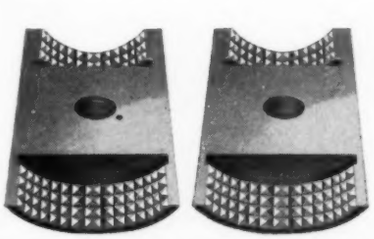
Standard vise jaws which are reversible for holding either round or square stock or hex head bolts.



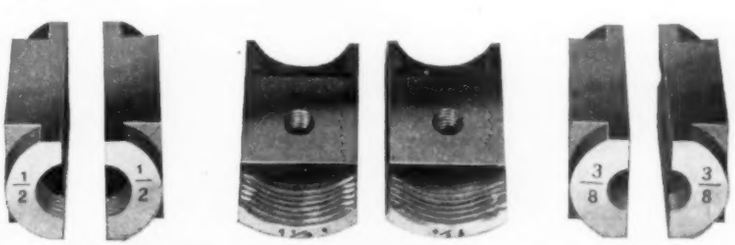
Smooth inserts for holding stock which must not be marred. (One set necessary for each size—extra equipment.)

Illustrated at left and below are the various types of vise inserts which can be supplied with the "RAPIDUCTION JUNIOR". The machine is made in two sizes: No. 541 with a bolt range of 3/16" to 1-1/4" N. C. or Whitworth; 3/16" to 1-1/2" N. F. or B. S. F.; and No. 542 with bolt range of 3/16" to 1-1/2" N. C. or Whitworth; 3/16" to 1-3/4" N. F. or B. S. F. Both models have a regular pipe and nipple range of 1/8" to 1-1/4". Full details on request. Use form below.

Illustrated below are threaded inserts for holding threaded end of short nipples; each set holds two sizes: (1/4" & 3/8") (1/2" & 3/4") (1" & 1-1/4")—extra equipment.



Diamond point inserts for gripping plain ends of short nipples; each set holds two sizes (1/4" & 3/8") (1/2" & 3/4") (1" & 1-1/4") —extra equipment.



THE OSTER MANUFACTURING COMPANY
2049 EAST 61st STREET • • • CLEVELAND, OHIO, U. S. A.

( ) Send complete description of "RAPIDUCTION JUNIOR" Threading Machines.

( ) Give name and address of your distributor in my area.

NAME .....

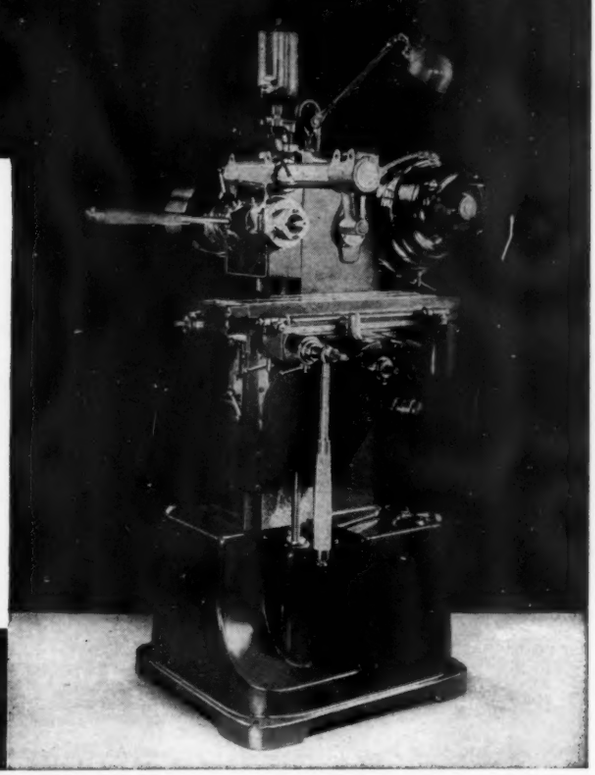
ADDRESS .....

CITY ..... STATE .....

Mail This—

THE NICHOLS HAND MILLING MACHINE

handles a wide variety of parts at high speed and low cost . . . .



This sturdy, versatile, precision machine—the latest development in this type of hand miller—incorporates features which increase its utility and ability to handle a wide variety of operations at high speed and low cost as compared with larger, slower machines.

Because of its ease of set-up, high cutting speeds and maintained precision, together with elimination of unnecessary friction, it is ideally suited to tool room production requirements. In proportion to its price, the "NICHOLS" is considered one of the most productive machine tools in the field. Its wide use in modern shops is outstanding evidence of its indispensability for today's requirements.

CONDENSED SPECIFICATIONS

Longitudinal Feed—10"
Traverse Feed—7"
Vertical Feed of Knee—13½"
Vertical Movement of Head—4½"
Spindle speeds—100, 200, 600 and 1200 R.P.M.

Write for Illustrated Bulletin, giving complete information

W. H. NICHOLS & SONS

WALTHAM, MASS., U.S.A.

END MILLS ARE SCARCE...MAKE 'EM LAST

Use your WELDON SHARPENING FIXTURE

COMPLETE!
SELF-CONTAINED!

Quickly re-sharpens End Mills of 3/16" to 1¼" shank diameter • Requires no centers or lead cams • Releases major production equipment • Designed for any grinder with flat table • No table movement necessary • Operated by trained or unskilled workers • Provides tool conservation — a vital war factor.

SIMPLE!
CONVENIENT!
FLEXIBLE!

THE WELDON TOOL CO.

3002 WOODHILL ROAD • CLEVELAND, OHIO

"Yesterday's Pioneer — Today's Leader"

END MILLS • GROUND CIRCULAR AND FLAT FORM TOOLS • SCREW MACHINE CAMS • "TU-LIP" COUNTERBORES

National Acme CENTRIFUGE SAVINGS

FIT INTO YOUR WAR PRODUCTION PICTURE, TOO!

Centrifuge savings are applied to small shops like this and to hundreds of machines of all kinds employing thousands of gallons of coolants.

Machines take their worst beating when allowed to run with coolants and lubricants containing accumulated grit and other contamination. Merely separating chips and returning the coolant plus make-up is both unsafe and costly.

Clarification with a National Acme precision built centrifuge removes all the finely divided gritty materials, and tangible savings in any shop are these —

You grind and replace cutting tools less frequently.

A higher percentage of your product passes inspection.

Machine bearings and other operating parts show much slower deterioration.

You materially reduce both the quantities and costs of coolants and lubricants.

Our centrifuge engineers will freely show you the application best suited to your shop. *Complete Catalog, P-41.*

Destructive grit removed from coolant used one day.

NATIONAL ACME CO.

170 EAST 131ST STREET • CLEVELAND, OHIO

ME-GRIDLEY 4-6 AND 8 SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATICS • AUTOMATIC THREADING DIES AND PS • SCREW MACHINE PRODUCTS • THE CHRONOLOG • LIMIT SWITCHES • SOLENOIDS • POSITIVE CENTRIFUGE • CONTRACT MANUFACTURING

PRODUCE PRECISION
Internal or External
THREADS . . . FASTER!

Below is shown set up for i
ternal threading, the millin
hob is revolved eccentrically
about the work and simultane
ously rotated into the work fo
the full depth of the thread. Th
cutter then rotates on its ow
axis and is carried around th
work and simultaneously ad
vanced by means of a lea
screw to produce the desire
helical thread.

Above is shown the spindle nose equipped with a hardened and ground 12-cutter thread milling head for cutting external threads from 1" up to and including 4" in diameter. The same eccentric milling action is employed as in the cutting of internal threads described above.

with the

NEW MURCHEY No. 32 THREAD MILLING MACHINE

Featuring a unique eccentric milling action described above, the new Murchey Thread Milling Machine is setting new records for speed and precision in the production of munitions threads. For example, on one job it is cutting a 2 7/16" thread in the base end of anti-aircraft shells faster than one a minute! Internal or external threads from 1" to 4" in diameter and up to 3" in length can be threaded right up to a shoulder if necessary. Maximum efficiency in operation is obtained through the completely hydraulic work cycle and the Reeves variable speed drive which permit the selection of exactly the right speed and feed for every job. And in the cutting of deep, coarse threads, the heavy box-type bed and the keyway in the fixture table help to maintain rigidity and perfect alignment. If you are looking for increased speed and maximum accuracy in munitions and aircraft threading, let us send you further details of the latest Murchey thread production equipment.

We also manufacture all types of Collapsible Taps, Self-Opening Die Heads, Bolt and Pipe Threading Machines and Pipe Cutting-Off Machines.

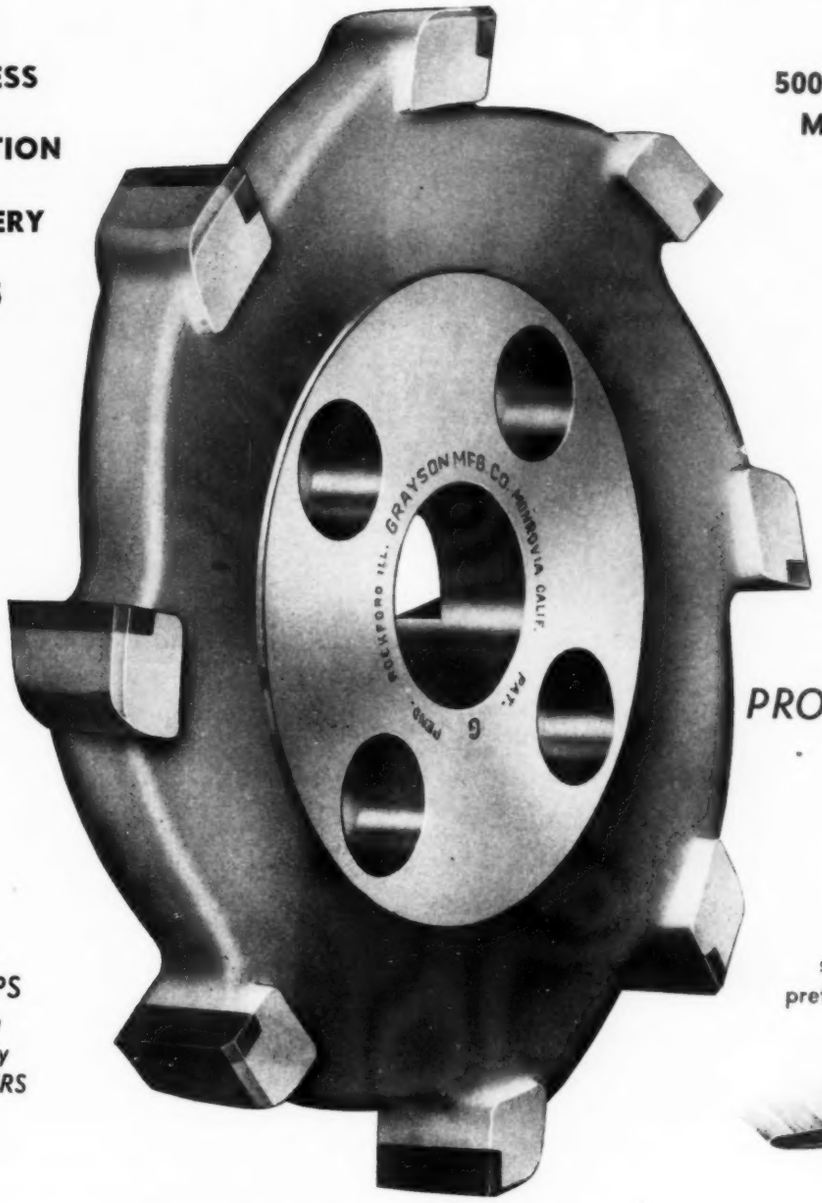
THE MURCHEY MACHINE & TOOL COMPANY
951 PORTER STREET, DETROIT, MICHIGAN

RIGHT on the NOSE,

RIGIDLY clamped, with four **STOUT** screws,
is the **IDEAL MOUNT** for **CEMENTED CARBIDE**
FACE MILLING CUTTERS

A NEW PROCESS
and
MASS PRODUCTION
permit
PROMPT DELIVERY
at
LOW PRICES

500% TO 1000%
MORE PARTS
per
grinding
of
cutter



TRIPLE SPEED

DOUBLE PRODUCTION

ALL CARBIDE TIPS
Bonded to Grayson cutters, are nationally RECOGNIZED LEADERS

satisfactory
preference rating
essential

The Illustration on this page is the exact size of
our **6½" FACE MILL** for mounting on a **#40 SPINDLE** nose **PRICE $43.00**
The **8½" FACE MILL** is machined to fit a **#50 SPINDLE** nose **PRICE $75.00**

IMMEDIATE DELIVERY ON SPECIAL FACE MILLS FOR ALUMINUM, BRASS AND CAST IRON. IN ORDERING, SPECIFY "ABC"

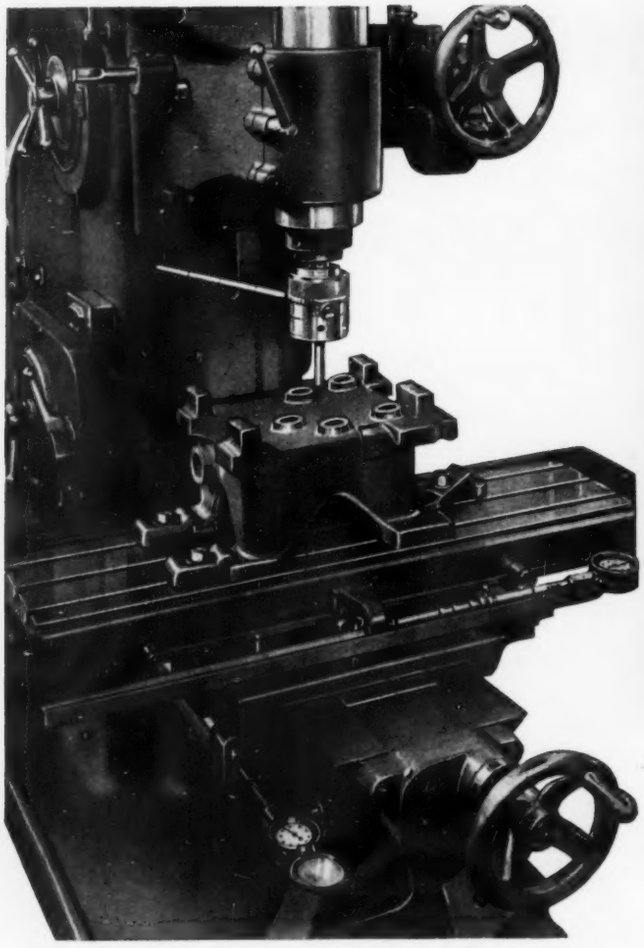
PATENTS PENDING

"MORE MILLING WITH LESS MACHINES"

GRAYSON MANUFACTURING COMPANY

MONROVIA, CALIFORNIA

TALCOTT BLDG. ROCKFORD, ILLINOIS



A typical jig boring job is done on a KNIGHT Miller. With dial indicators, all five holes were accurately located and bored. At the same setting, the corner pads were milled, insuring squareness with the bored holes.

- Internal and external milling is done at one setting
- Step milling is made easy by getting vertical adjustment on spindle
- Profiling, boring, and slot-milling is all done at one setting
- Precision boring is done, using dial indicators for accurate locating
- Rigid spindle makes possible deep end milling
- Jig boring is possible because of dial indicators
- In experimental work you can machine many jobs completely on this one machine and handle difficult operations without special equipment
- For limited and special production you can keep costs down and maintain quality without special tooling

WRITE FOR NEW CATALOG

Wide Range

KNIGHT Millers ADD SPEED TO EACH SHIFT'S PRODUCTION···

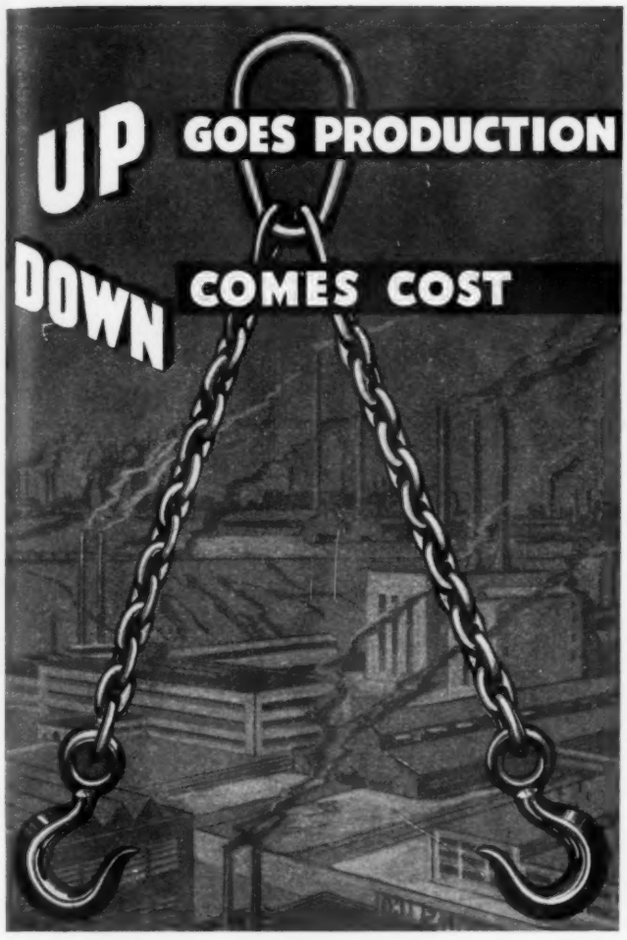
KNIGHT VERSATILE MILLER ACCURATE · RIGID

Large work or small—milling or boring, roughing, or accurate finishing cuts—all are handled to equal advantage on this wide range machine. Sixteen changes in speed, in either direction, give the spindle ample range to meet a wide variety of requirements.

Greater speed is realized by users of KNIGHT Millers because of (1) the short time required to make set-ups, particularly difficult ones (2) the elimination of additional set-ups or at least the simplification of them (3) the quick and accurate location of holes and surfaces, especially when dial indicators are used (4) the quick change of vertical settings by moving the spindle instead of the work (5) the fast method of changing cutting tools (6) the swiveling table which greatly reduces the most expensive element in tool room operation—that of time waste in set-up work.

●

W. B. KNIGHT MACHINERY CO.
• ST. LOUIS, MISSOURI •



HERC-ALLOY SLING CHAINS

double STRENGTH
SERVICE
SAFETY

Smooth movement of materials through manufacturing departments means more profits. Herc-Alloy Sling Chains, America's FIRST alloy sling chains, are facilitating speedy production, safeguarding men and materials, and reducing costs in every type of industry.

Fabricated from a high-grade alloy steel of nickel and molybdenum, Herc-Alloy Sling Chains have the endurance and stamina to withstand the toughest industrial assignments. Heat treating under rigid pyrometer control insures uniformity and ductility. Herc-Alloy Sling Chains never crystallize or develop grain growth . . . therefore, they NEVER require annealing. Links are electric welded by the patented "Inswell" process providing 25% more metal at the critical point in the link . . . at the weld. For double strength, service and safety, plus cost-cutting performance, specify Herc-Alloy Sling Chains.

CM manufactures a complete line of chain for every application. Trained engineers are available for consultation on your chain problems. Write for Herc-Alloy catalog today.

COLUMBUS-McKINNON
Chain **CORPORATION**
(Affiliated with Chisholm-Moore Hoist Corporation)

124 FREMONT AVE. TONAWANDA, N. Y.
Branch Offices: NEW YORK • CHICAGO • CLEVELAND

FEDERAL
TAPERLOCK GAGE HANDLES

★ MADE OF PLASTIC MATERIAL

Developed to release for other important uses, the critical metal generally used for Gage Handles.

ACCURATELY MADE . . .

They conform to standard dimensions for gages, accepted throughout the industry. Plastic material protects gages from bodily heat, helping to safeguard their accuracy.

LIGHT IN WEIGHT . . .

Made of durable plastic material, much lighter than metal. This permits greater sensitiveness to touch, and reduces fatigue from long continued use. Marked with the same lettering stamps that are used for metal handles.

LOW IN COST . . .

About half the cost of metal handles—a real saving. They are available without delay, in any quantity.

FEDERAL TOOL CORPORATION

401 North Leavitt Street - - Chicago, Illinois

early delivery

MOREY 8" VERTICAL SHAPER

EQUALLY EFFICIENT IN YOUR TOOL ROOM OR MANUFACTURING DEPARTMENT

features

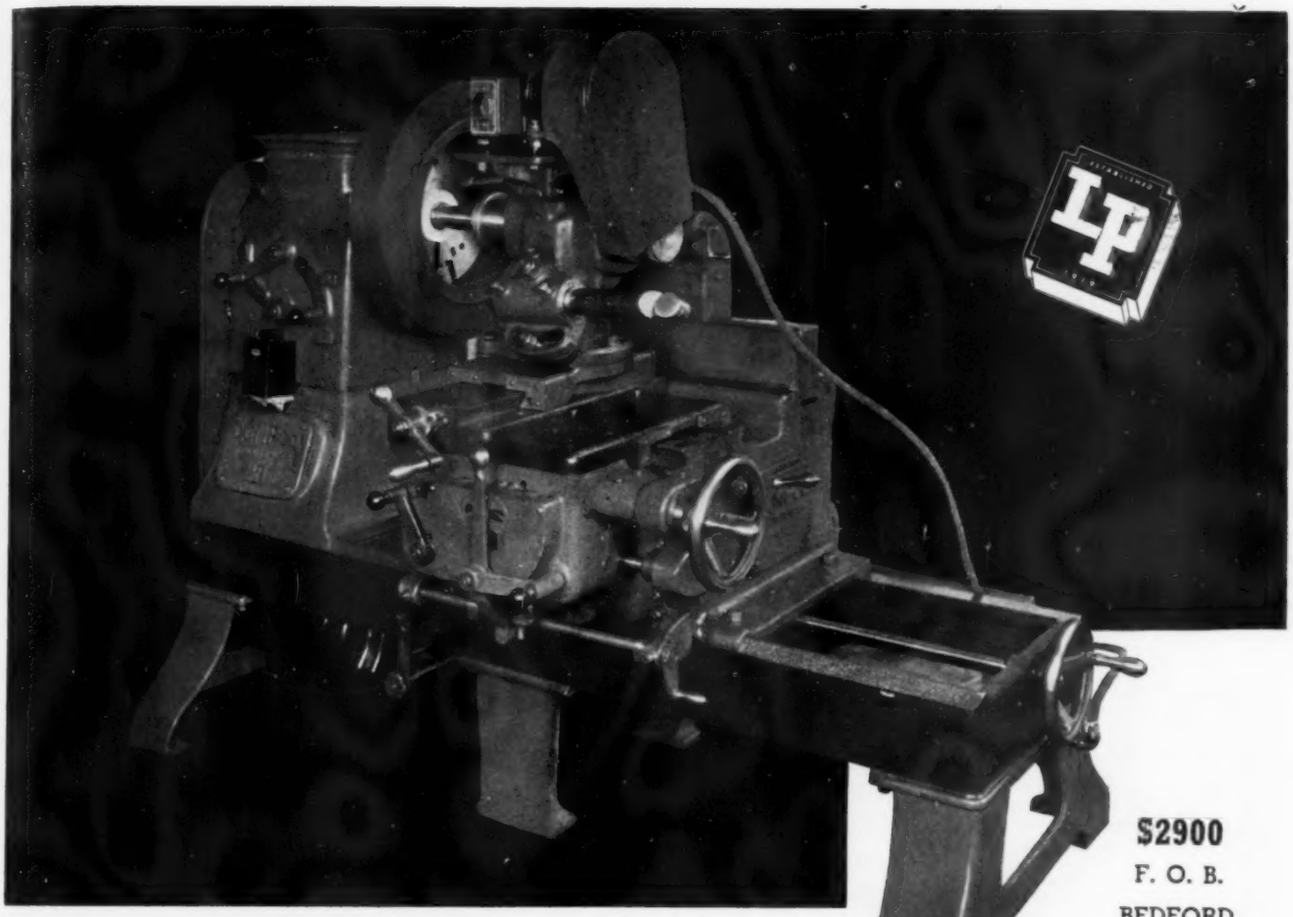
Precision . . . Easily handled—your operators will appreciate it . . . **Cutting Stroke** changed quickly . . . **Feeds** varied instantly . . . **Power** rapid traverse in all directions . . . **Brake** for ram automatically applied . . . **Bijur Lubrication** . . . **Timken Bearings**—Bull gear mounted on Timken Bearings. Roller table mounted on Timken Bearings . . . **Modern Design**—built to the highest standards of workmanship and materials—simplified operation, powerful yet finger-tip control . . .

Also built in 12" and 14" sizes

DESIGNED AND BUILT BY **MOREY MACHINERY CO., INC.**

Ask for Circular No. 726

410 BROOME STREET NEW YORK, N.Y.



$2900
F. O. B.
BEDFORD,
OHIO

HEAVY-DUTY LEMPCO DU-ALL GRINDER AND TURNING MACHINE

Designed for precision, production runs, this new Lempco Universal Type Grinder is practically foolproof in operation. Simple control levers are all conveniently grouped within easy reach of operator. Apprentices, or even women, produce fine finishes or heavy roughing cuts with equal ease. Rugged, heavily reinforced at stress points, fast and accurate, the Du-All handles external and internal grinding or turning with maximum efficiency and economy.

SPECIFICATIONS

Maximum Distance Between Work Centers	44"*
Work Spindle Speeds (4 quick selective)	20-40-60-120 RPM
Table and Cross Feeds (3 quick-change)	.005", .010" & .016"
Swing, over 3 ways (Diameter)	53"
Grinding Range: Max. I.D., 29"; Max. O.D., 18"	
Turning Range: Max. I.D., 48"; Max. O.D., 22"	
Min. Grinding or Turning Range	2"
Face Plate Diameter	18"
Table and Cross Slide Travel (each)	12"
Carriage Travel	19"
Length of Bed (Standard length)	5' 11½"*
Weight (Shipping)	3200 lbs.

*Extra length beds available at extra cost.

Prompt Delivery! Priorities Can Be Had — Write Us.

LEMPCO
PRODUCTS · INC.
BEDFORD · OHIO · U·S·A
ESTABLISHED 1919

SEE ONE WORK — MAIL THIS COUPON

LEMPCO PRODUCTS, INC., Dept. AM, Bedford, Ohio
GENTLEMEN: Tell me the plant or shop nearest my place of business where I may see a DU-ALL Grinder

NAME.....

ADDRESS.....

CITY..... STATE.....

Choose your shaper to fit your work

THE NEW VERNON PRECISION BACK-GEARED 12" SHAPER has all the important advantages of large machines plus fast production and big savings in first cost, power and floor space. Within its capacity it will do anything as accurately as a larger machine—and do it faster and more economically.

It has the full range of essentials—power, strength, rigidity, speed, smoothness, accuracy, convenience in operation, adjustability, and long life. Its back-gearing provides ample power to drive through deep cuts without chatter or stall. Its helical-type bull gear is mounted in large Timken Tapered Roller Bearings and is adjustable for wear. Its speed is infinitely variable within the range of 15 to 170 strokes per minute.

These and other features make the new Vernon the best shaper on the market to relieve larger machines and get work out faster. Orders placed now get prompt delivery! Send for new bulletin with complete specifications.

MACHINERY MANUFACTURING COMPANY
1915 EAST 51 ST., VERNON . . LOS ANGELES, CALIFORNIA
Vernon Line of **HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS**

SPEED UP PRODUCTION OF SMALL ARMS *and* MAINTAIN ACCURACY . . . *with the* "HARTFORD" QUICK-ACTING MILLING VISE

Now's the time to take advantage of this time-saving, time-tested, easily handled milling vise. With its power, speed, accuracy and strength, the "HARTFORD" can be of outstanding assistance in boosting small arms production milling.

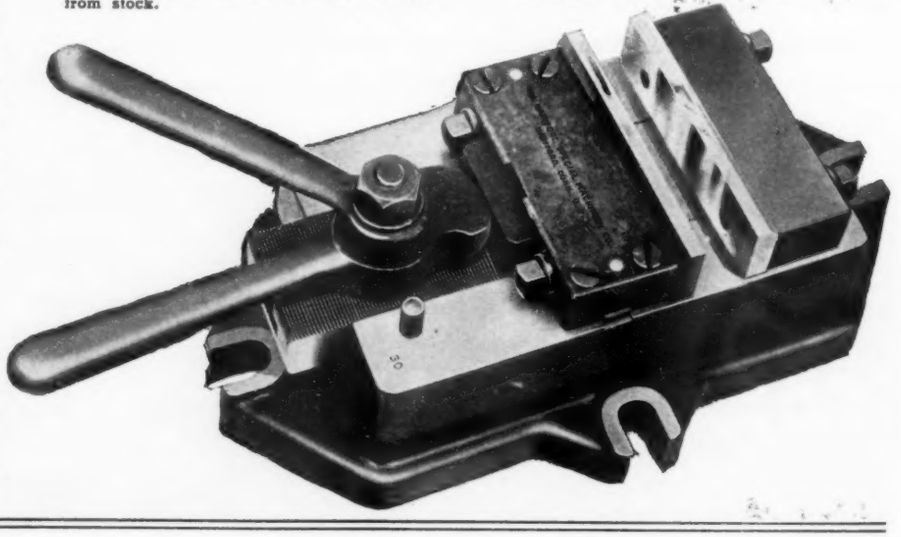
All operations are handled by the manipulation of two handles, the lower cam-faced one providing quick opening and quick return and the top eccentric lever exerting a tremendous pressure for holding the work. Both handles can be locked by the operator with one hand after a little practice. Upon releasing the eccentric binding lever, a quarter turn of the cam lever opens the movable jaw approximately ⅞" —a convenience feature when working on comparatively thin pieces because it permits quick and easy chip clearance as well as instant release of work.

The movable jaw in the "HARTFORD" is in the position usually occupied on screw type vises by the solid jaw, a design which assures perfect jaw alignment as well as virtual indestructability.

Screw holes of the jaws of the "HARTFORD" are interchangeable with those of the No. 2 B&S Vise. Inasmuch as all parts are made with tools and to gauges, replacement parts can be furnished promptly from stock.

SPECIFICATIONS
MADE IN PLAIN and SWIVEL TYPES

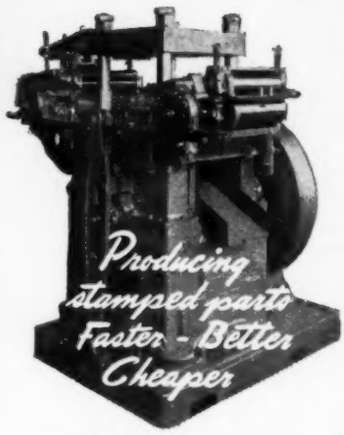
Width of Jaw—5"
Depth of Jaw—1 3/16"
Max. opening (Plain Jaw) 2⅜"
Max. opening (Swivel Jaw) 2¼"
Weight 40≈
Dimensions (overall) 13" long—8" wide—5" high



WRITE AT ONCE FOR FURTHER INFORMATION

THE HARTFORD SPECIAL MACHINERY COMPANY
HARTFORD CONNECTICUT

The unique Dieing Machine produces intricate stampings to high precision at greatly increased rates



50-TON DIEING MACHINE

Other capacities: 10 tons to 300 tons

Machine gun belt link produced complete one per stroke to extreme precision limits at exceptionally high speed.

Cartridge clip for caliber .303 rifle produced complete one per stroke at record-breaking high production.

Airplane strut seat of .031" brass produced complete one per stroke at new high rate.

Another of the numerous machine gun belt links produced from flat material complete per stroke to precision limits.

This shell, involving 8 operations, is produced complete one per stroke at high speed including 1¾" draw.

Airplane fuselage hinge of duralumin produced complete per stroke in continuous strip to high precision including **BROACHING.**

Guns, bombs, planes—their operation relies on precision stampings made COMPLETE PER STROKE on Dieing Machines

In the greatly intensified program of ordnance and airplane manufacture, great reliance is placed upon the Henry & Wright Dieing Machine because of its unique advantages, especially its ability to produce intricate stampings at greatly increased rates to extreme precision. In the production of machine gun belt links, cartridge clips, mechanical time fuze parts, bomb components, airplane engine and instrument parts, and scores of other items whose precision affects the successful operation of fighting equipment—in all such stampings you find the Dieing Machine giving an unequalled combination of High Precision and High Production. Precision of product can consistently be held within .0002" limits when required. Production of one Dieing Machine equals that of 5 to 10 conventional presses and operators, producing 1 to 20 completed stampings per stroke at speeds up to 600 s. p. m. In addition, the Dieing Machine offers the advantage of conserving vital tools; die life is customarily increased 600% to 1200% because of the remarkable operating precision of this unique automatic press.

MUNITIONS STAMPING COUNSEL

During nearly four years. Dieing Machines have been turning out an endless variety of stampings required by the war program. We believe we have the most complete fund of experience in this field, and gladly place the counsel of our engineers at your disposal.

TYPICAL MUNITIONS ITEMS AND ASSEMBLY OPERATIONS COMPLETE PER STROKE

STAMPINGS

- Machine gun belt links
- Mechanical time and contact fuze parts
- Rifle components
- Cartridge clips, or rifle charges
- Gas mask stampings
- Ammunition stampings
- Bomb components
- Shell parts
- Detonator stampings
- Airplane instrument, engine and fuselage parts

OPERATIONS

- Bullet assembling
- Primer inserting
- Automatic time and contact fuze assemblies

Request Catalog #42

THE HENRY & WRIGHT MFG. CO.

488 Windsor St. Hartford, Conn.

HENRY & WRIGHT DIEING MACHINES

FREE-

TO USERS OF H&G DIE HEADS

Instruction

BULLETINS COVERING

The Care of General Purpose Die Heads
Hobbed Chasers
Grinding Data on Insert Chasers
Style MM (Rotary) Insert Chaser Die Head
Style DMS Insert Chaser Die Heads
Style DM Insert Chaser Die Heads
Style TM Taper Cutting Insert Chaser Die Head
Styles SAM and SAMA Solid Adjustable Insert Chaser Die Heads
Model 1C Threading Machine

In addition, as a part of our service we publish "DIE HEADLINES"—an informative bulletin packed with practical thread cutting suggestions for improving production, quality and volume. Give description of machine and size and style of H & G Die Heads used with your request.

The Eastern Machine Screw Corp.

20-40 Barclay Street **New Haven, Conn.**

Hammond
OF KALAMAZOO

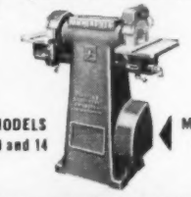
CARBIDE TOOL GRINDERS

"Keep 'em Sharp"

WRITE TODAY FOR LATEST BULLETIN NO. 201

MODEL 4 — Combination Chipbreaker and Grinder (Illustrated Upper Right)
MODEL 6 — Carbide Tool Grinder
MODEL 10 and 14 — Wet or Dry Carbide Tool Grinders with Patented No Spray-No Splash Wheel Guards
MODEL 10A — Carbide Tool Grinder

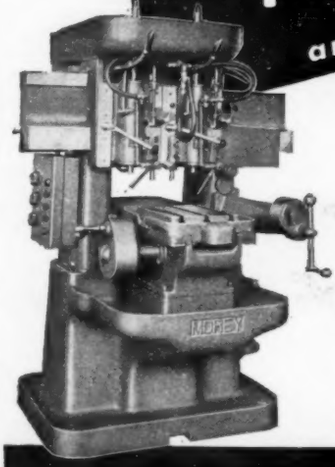
VISIT OUR BOOTH D-122 METAL SHOW CLEVELAND OCT. 12-16



Hammond Machinery Builders INC.
1618 DOUGLAS AVENUE • KALAMAZOO • MICHIGAN
EASTERN BRANCH: 71 WEST 23RD STREET, NEW YORK CITY

Preloaded Precision Bearings for Spindles

MOREY 12M HIGH-SPEED VERTICAL PROFILER and MILLER



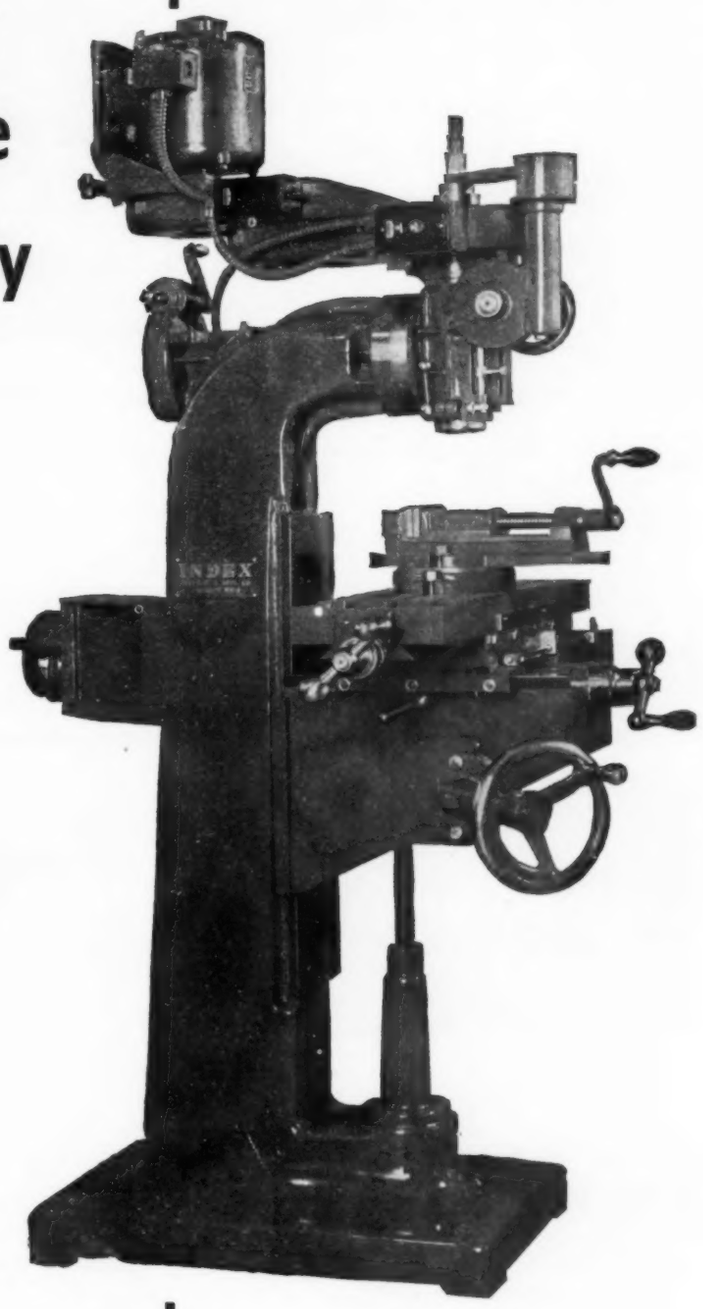
Two spindle or single spindle

Speed and more speed in the production of interchangeable parts requiring milling of any contour or outline is yours in the MOREY 12M. Provision for increased clearance between spindles and table.

Ask for Bulletin 680-A

MOREY MACHINERY CO., INC.
410 Broome Street **New York, N. Y.**

A Simple and Practical Machine For Approximately $1000.00



That was the original idea of the Index Machine & Tool Company in bringing out the 40-H INDEX.

Rugged and fast for its class. Designed to do end mill work with end mills from ⅛" to ⅝" in tool steel. With a spindle running in super precision pre-loaded ball bearings . . . with verniers for locating . . . with power feed to spindle for boring.

This has now long been an accomplishment, TRIED & PROVEN by hundreds of Defense Plants on parts for all kinds of war equipment from binoculars to battle ships.

If you do not know about this machine you should write at once for full particulars from

BLANK & BUXTON MACHINERY CO.

3100 E. MICHIGAN AVE. • JACKSON, MICH.

NEW ROCKFORD PRESSES

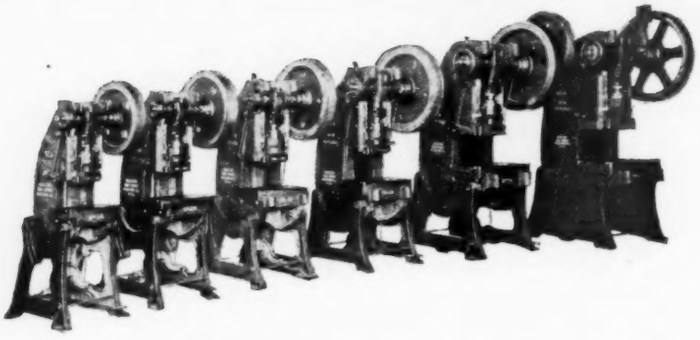
ANNOUNCING!

Removal of our plant and offices to—

6411 W. BURNHAM AVE.
MILWAUKEE, WISCONSIN

Prompt deliveries possible on certain sizes

WIRE **WRITE**



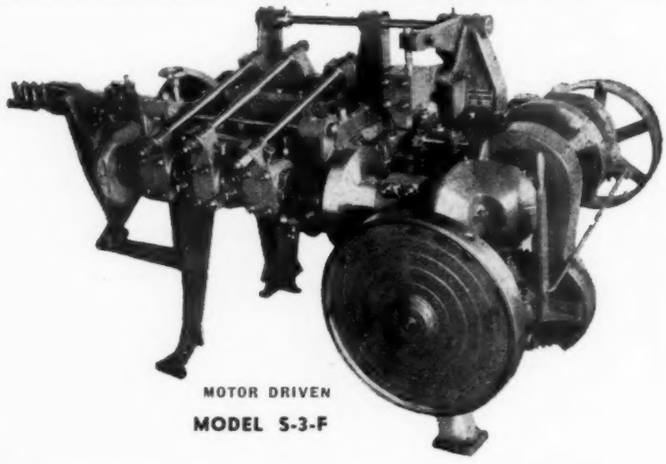
The INCLINABLE Line—14 to 100 Ton—
EMBODIES EVERY MODERN FEATURE

DIMENSIONS	1R	2R	3R	4R	5R	5½R	6R	7R	8R
Diameter of crankshaft at bearings and crankpin	1⅞–2¾"	2¼–3½"	2½–3¾"	3–4½"	3½–5¼"	4–5¼"	4–6"	4½–6¾"	5–7½"
Standard stroke of slide	2"	2"	2"	3"	3"	3"	3"	4"	4"
Maximum stroke of slide	4"	5"	6"	6"	7"	7"	8"	8"	10"
Area top of bolster, F to B by R to L	9½x16½"	12x19"	13x22"	14x26"	18x32"	18x32"	21x34"	24x41"	27x45"
Approximate weight Fly Wheel Press	1275	1890	2900	4500	7600	7700	9700	18500	24000
Approximate weight Single Geared Press	1350	2100	3400	5100	8750	8900	10700	20000	25600
Tons pressure (rated)	14	20	26	37	50	56	65	85	100

ROCKFORD IRON WORKS, INC.

STEP UP PRODUCTION OF FORMED PARTS

. . . with the
NILSON AUTOMATIC METAL and WIRE FORMING MACHINES



MOTOR DRIVEN
MODEL S-3-F

Today's requirements for higher efficiency, greater speed and products of greater uniformity and accuracy are met in the new NILSON RIBBON STOCK FORMING MACHINES. These machines are the achievement of over fifty years accumulated experience in designing and building metal forming machines. Careful selection of materials and skilled workmanship result in machines that are famous for long life and low maintenance.

FEATURES THAT CONTRIBUTE TO BETTER, FASTER WORK

Superior features of the NILSON four-slide forming machines are the result of long experience and include:

. . . open construction of press and forming tools.
. . . patented slide feed which has an independent cam-operated wire gripping device.
. . . transmission of power operating wire feed through a straight line.

Send for 4-page circular giving further information as well as detailed specifications of sizes and capacities.

• •

We have been engaged in the design and production of special automatic machinery of high production capacity for over thirty years. We are prepared to render a complete service in connection with the design and production of automatic machinery of every description. Consult Nilson on your requirements.

THE A. H. NILSON MACHINE CO... *Bridgeport, Conn., U.S.A.*

A flexible machine that is the last word in simplicity of operation

HI-SPEED HONING and LAPPING MACHINE

for use with any standard make honing head

Illustrated is No. 0 Machine equipped for 36" stroke with 80" under the spindle.

HONES CYLINDERS up to 24" in diameter . . . with STROKES from 20" to 72" . . .

IDEAL FOR PRODUCTION JOBS INVOLVING:

Aircraft parts . . . Ordnance parts . . . Diesel engines . . . Compressors . . . Pumps . . . Internal combustion engines . . . Steam cylinders, etc.

Speed up war work involving internal cylindrical surfaces by utilizing a HI-SPEED Honing Machine. When used with proper honing head of any standard make, the HI-SPEED machine produces accurate, straight, round, smooth bores—amazingly fast.

Unique positive stop and dwell system makes it possible to stop the spindle without shock or impact at the bottom of each stroke, at any point within the stroke range and hold the spindle without reciprocation, at that point up to 1½ minutes. Ideal for "blind hole" honing and straight line lapping or honing.

All controls are located at the front of the machine at the operator's station . . . No ladders to climb . . . Stroke setting, hone withdrawal, short stroking at any point, changes in speed of reciprocation or rotation of the spindle made instantly from operator's station.

The HI-SPEED Honing Machine is made in 4 sizes, any one of which can be had with strokes up to 72"... Designed for use with any standard make of honing head.

Tell us your requirements—and our engineers will promptly furnish you with complete information, prices and early delivery dates.

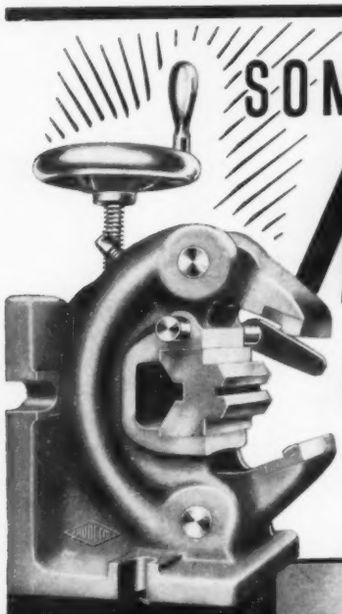
NOTE THESE SPECIFICATIONS:

Model No.	No. 0	No. 1	No. 2	No. 3
Stroke (standard)	20"	36"	48"	72"
Working Base Area (standard) Auxiliary Tables available	21" x 22"	31" x 31"	31" x 31"	48" x 54"
Height Under Spindle Nose (up) Added Height Available on Order.	48"	60"	75"	100"
Spindle Diameter	2¾"	2¾"	2½"	2¾"
Spindle Speeds Through Gear Box	4	4	4	8
Main Drive Motor (standard)	7½ hp	10 hp	15 hp	20 hp
Coolant Pump Volume, Motor Driven	14 gpm	18 gpm	18 gpm	25 gpm
Maximum Bore possible to hone with standard spindle drive motor	10" Dia.	12" Dia.	16" Dia.	20" Dia.
Maximum Overall Diameter of Cylinder possible to place on standard base	18"	27"	27"	44"
Floor Area	44" x 60"	60" x 80"	60" x 80"	60" x 108"
Overall Height	11'6"	15'3"	18'3"	23'8"

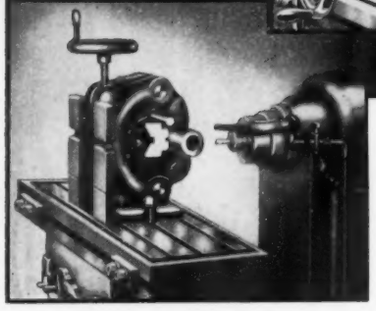
NOTE: Under our new policy of distribution, sales territories are being assigned to financially responsible, established dealers in the machine tool field. A few excellent territories are still open, and dealers are cordially invited to write us relative to sales representation.

AUTOMOTIVE MAINTENANCE MACHINERY CO.
2100 Commonwealth Avenue, North Chicago, Illinois

SOMETHING *New* HAS BEEN ADDED!



SELF-CENTERING SHAFT VISE



TO THE LINE OF **PRODUCTO**
MODERN MACHINE VISES

An entirely new idea in Vise construction in this Country. For machining keyways and slots in shafts or spindles — range of sizes ⅜″ to 3⅛″ diameter — suitable for vertical or horizontal mounting. Setting of Vise remains unaltered for all work diameters and insures accurate radial cuts. Shafts correctly located in V jaw by equal movement of two jaws. Hardened V jaw reversible in Vise.

Size of Base 8″ x 7¼″ — Approximate weight 80 lbs.

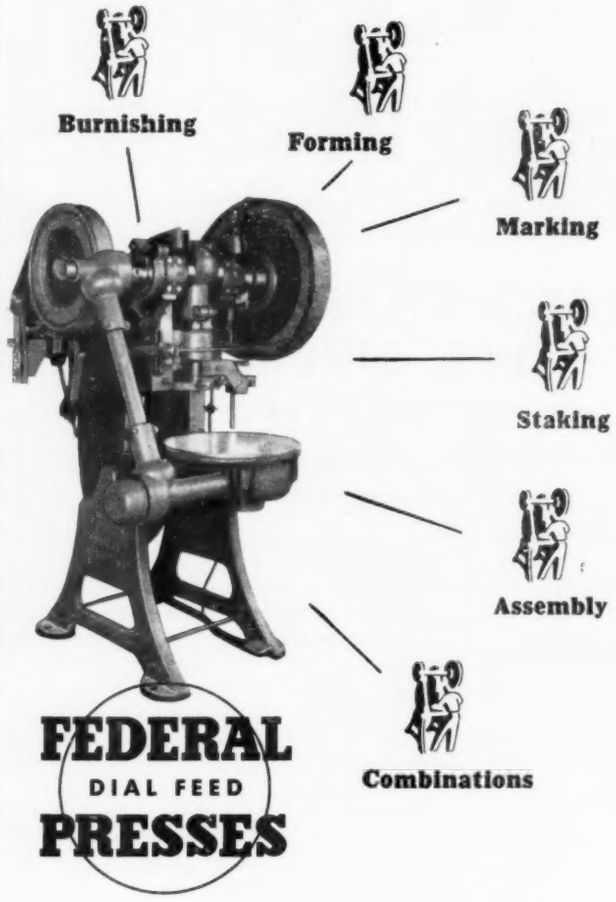
Write for circular

PRODUCTO

The **PRODUCTO MACHINE COMPANY**

990 HOUSATONIC AVENUE BRIDGEPORT, CONNECTICUT
3017 MEDBURY AVENUE DETROIT, MICHIGAN

V for *Variety* of jobs they can do



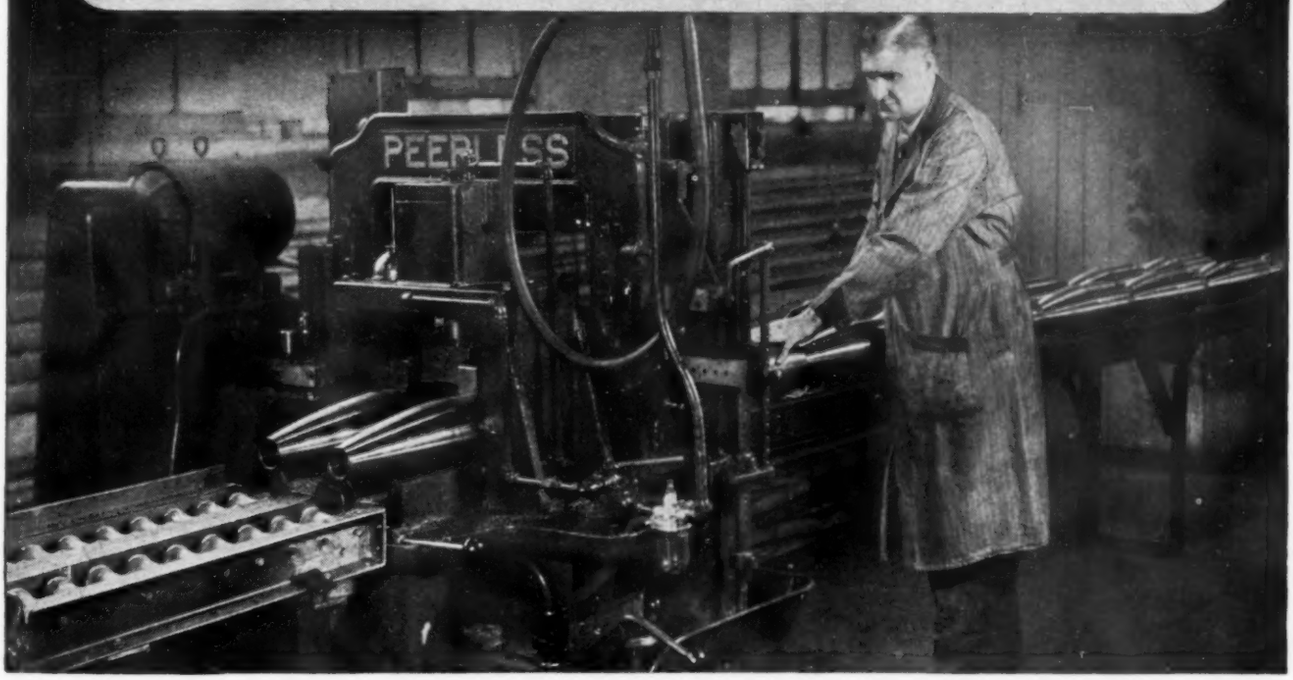
FEDERAL Dial Feed Presses are daily performing a wide variety of jobs which, until recently, were not thought of as press operations. Their versatility is limited only by the production engineer's resourcefulness. These precision presses are being used for primary, secondary and assembly work, and in some cases perform intricate combinations of all. Burnishing, forming, staking, and high speed marking are handled easily.

FEDERAL Dial Feeds are speeding war production in hundreds of plants. They are fast, safe, smooth, precise. Easily indexed to any part of crankshaft revolution, 90 to 180 degrees, giving long or short dial dwell—10 or 12 stations. Write today for facts or help on specific jobs.

THE FEDERAL PRESS CO.
610 Division Street, Elkhart, Indiana.

9 ***FEDERAL SIZES*** — Federal Open-Back, Inclinable Presses are available in nine sizes, with capacities ranging from six to 80 tons — either flywheel or geared type. They are the products of 40 years' experience in press building.

Safe FOR MEN AND METAL ...PEERLESS POWER SAWS



While sawing test samples for the Dow Chemical Company, a 14" Peerless High Duty (like the machine shown in the illustration above) cut 10½ sq. in. per minute. The bar of Dow metal was 11¾ inches in diameter — 108.43 sq. in. per cut. A two-tooth blade was used.

Haste with waste never was sound shop practice! And, today speeds that sacrifice SAFETY* cannot be tolerated.

Fast cutting with maximum safety for men and metal has won broad acceptance for Peerless Power Saws in our war industries. Peerless cool-running, straight-cutting blades remove as little as 1/16" of the metal. These fine cuttings are easily salvaged from the chip tray.

Peerless Power Saws also release their operators for other productive work while the cutting progresses smoothly and quietly. The patented, Peerless Four-Sided Saw-Frame, with Backing-Plate Blade-Support guards the life of the blade. Should the blade grow dull and break, under strain caused by neglect, the Peerless stops *automatically* before injury can be caused to MEN or METAL . . . Peerless effectively combines SPEED with SAFETY! The coupon entitles you to a set of the latest literature.

PEERLESS MACHINE COMPANY • RACINE, WISCONSIN

Peerless
METAL SAWING MACHINES

PEERLESS MACHINE COMPANY, Dept. M-1042, Racine, Wisconsin

*Mail information on Peerless Saws and the features which are helping war industries reduce the rate of man-days lost — 480,000,000 days lost in 1941.

- ☐ Mail catalog on Hydraulic type Saw for High Production Cutting
- ☐ Mail catalog covering Vertical type used for Die Block Work
- ☐ Mail catalog on Mechanical type Saw for production cutting
- ☐ Mail catalog on general utility and maintenance Saws

Company.....

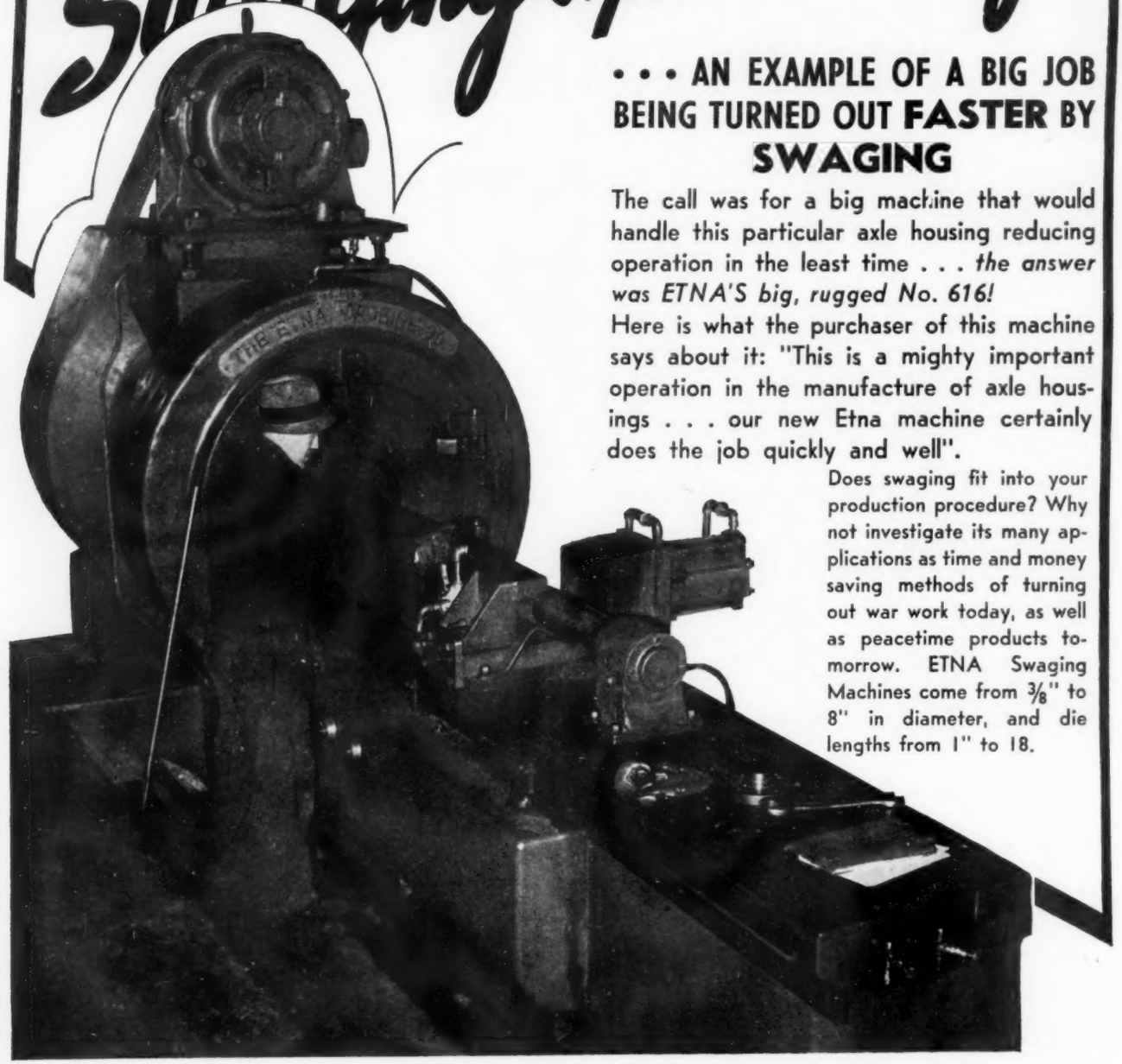
Individual.....

Street.....

City.....State.....

FAST, ACCURATE CUTTING DEMANDS POSITIVE BLADE CONTROL

ETNA'S BIG NO. 616 Swaging Axle Housings



• • • AN EXAMPLE OF A BIG JOB BEING TURNED OUT **FASTER** BY **SWAGING**

The call was for a big machine that would handle this particular axle housing reducing operation in the least time . . . *the answer was ETNA'S big, rugged No. 616!*

Here is what the purchaser of this machine says about it: "This is a mighty important operation in the manufacture of axle housings . . . our new Etna machine certainly does the job quickly and well".

Does swaging fit into your production procedure? Why not investigate its many applications as time and money saving methods of turning out war work today, as well as peacetime products tomorrow. ETNA Swaging Machines come from 3/8" to 8" in diameter, and die lengths from 1" to 18.

IF IT'S A QUESTION OF TAPERING, SIZING OR REDUCING OF ROUND SOLIDS OR TUBING

"Ask ETNA about Swaging"

THE ETNA MACHINE COMPANY

TOLEDO . . . OHIO

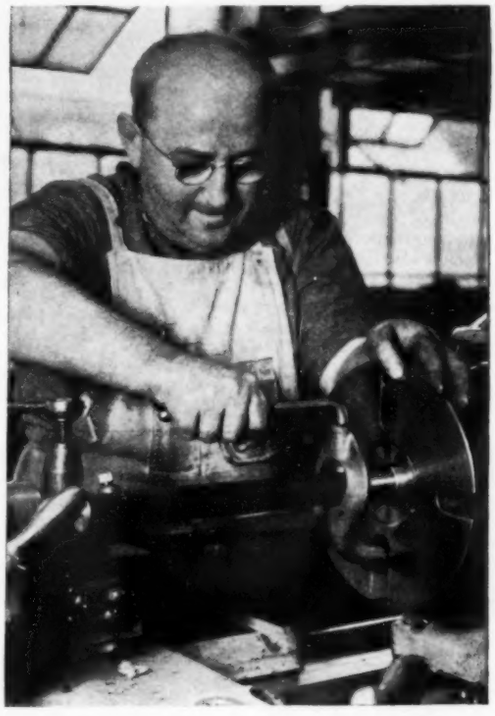
HOW AND WHY
WILLIAMS' TOOLS AID WAR PRODUCTION

J. H. WILLIAMS & CO., *Drop-Forgings and Drop-Forged Tools*, BUFFALO, N. Y.

DATA ON "VULCAN" LATHE DOGS

Lathe Dogs provide a simple and flexible means of driving shaft and other between-centers work on engine and semi-automatic lathes. Their universal use makes them an important metal-turning accessory and makes a knowledge of available standard types desirable at this time.

Williams' "Vulcan" Lathe and Milling Machine Dogs cover a wide range of shop, tool-room and manufacturing requirements. All are drop-forged from a strong, tough grade of carefully selected steel. Screws are of special steel, hardened and tempered, and are threaded U. S. Standard with the exception of those above 1" diameter which have eight threads to the inch. Both "Safety" and "Non-Safety" types, as illustrated, are available and interchangeable. Safety screws (& wrench) are furnished unless otherwise specified.



Safety for the operator is an important feature of this "Vulcan" Dog equipped with a square recess "safety" screw. There are no sharp projections to injure the operator's hands or catch his clothing.

"Vulcan" Clamp Lathe Dogs

The case-hardened nuts with which the Screws of this clamp are equipped, provide a ready means of arrangement for the minimum projection of screws beyond the body of dog and thus lessen danger to the operator when tool is in use.

Nos. 61 to 64 inclusive, 1⅝" to 3¼" capacity

"Vulcan" Milling Machine Dogs with Flat Bent Tail and one Screw

Designed for taper work carried between centers on milling machines, the flat tail works in the head-slot without the backlash unavoidable in Dogs with taper tail. Serves also as a heavy pattern lathe dog. Heads are of sufficient size to permit re-tapping for larger size screws, as the threads wear. Non-safety screws only are furnished with "Vulcan" Milling Machine Dogs. They are threaded U. S. Standard and made of a special grade of steel, hardened and tempered.

Nos. 42 to 48 inclusive, 1/2" to 2" capacity

"Vulcan" Lathe Dogs with Bent Tail and one Screw

Nos. 1 to 13 inclusive, 3/8" to 5" capacity

"Vulcan" Heavy Service Lathe Dogs with Bent Tail and two Screws

Nos. 112 to 114 inclusive, 4" to 6" capacity

WILLIAMS
SUPERIOR DROP-FORGED TOOLS
Headquarters
for over half a century for
DROP-FORGINGS and DROP-FORGED TOOLS

Sold by Leading Industrial Distributors Everywhere

Speed up Your Production!

HANDLE YOUR CUTTING-OFF OPERATIONS (3" and larger) ON THIS NEW MACHINE . . . . .

The Porter-McLeod Cold Metal Sawing Machine will definitely step-up your production and quickly pay for itself when you have to cut stock 3 inches and up.

An outstanding production cutting-off machine, with modern enclosed motor drive and centralized controls, the new 8" Porter-McLeod will handle single pieces or permit nesting of bars or shapes for cutting off multiple units simultaneously.

Feed of blade upward to the stock provides blade protection against riding or bumping. Support of blade near its rim prevents buckling and maintains accuracy of cutting. By pulling blades through the cut, large size stock can be cut with less power and with assurance of a straight cut. Standard feed of the machine is 3 inches per minute and is made by means of a friction disc which insures against blade breakage especially when coming in contact with hard spots in the stock being cut. Feed can be increased for cutting brass and other non-ferrous metals.

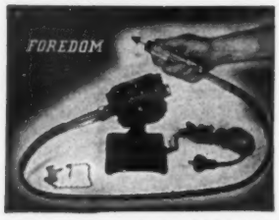
Regardless of the material to be cut, you can depend on this machine for the utmost in productive capacity, economy and speed.

The machine is driven by a 5 H.P. 1800 R.P.M. motor and is equipped with magnetic switch and push-button station. Detailed specifications available on request.

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASS., U.S.A.

MACHINE TOOL COMPANY

FOREDOM FLEXIBLE SHAFT MACHINES Solve Many Production and Maintenance Problems



Model illustrated is FOREDOM No. 340. Comes with either foot or hand-operated rheostat at $45.70. (Available with suspension-type motor, No. 240 at $43.20, including foot rheostat). Other models as low as $23.50.

In the making of an intricate die or mold . . . in the de-burring, finishing, cleaning, polishing, etc. of small irregularly-shaped parts, or in the removing of high spots on gears (WITHOUT an expensive DISASSEMBY and RE-SET) . . . . in any one of many similar tasks—you can rely on a FOREDOM to do a better and quicker job.

These features combine to make FOREDOM MACHINES the most versatile of war plant aids: 1) Four types of interchangeable handpieces, including sizes as small as a pencil; 2) A choice of suspension or bench type; 3) A wide range of accessories. For close corner work FOREDOMS have no equal.

SERVING AT VITAL SPOTS IN LEADING WAR PLANTS

Many production men are spotting these general utility FOREDOMS at convenient points about their plants, particularly at EACH POINT OF FINAL ASSEMBLY OF SMALL PARTS. FOREDOM MACHINES are used on metal, plastics, glass, wood, porcelain, etc. Ideal for identification-marking of products and tools. Less fatiguing to women operators. Hundreds of war plants are eliminating time-taking hand jobs with FOREDOMS. These include: Ford, General Motors, Bendix, Westinghouse, Warner, Allis-Chalmers, Remington Arms, Curtiss-Wright.

Order from your supply house, or direct. Write for complete Catalog No. 374

FOREDOM Electric Co.
27 PARK PLACE NEW YORK, N. Y.

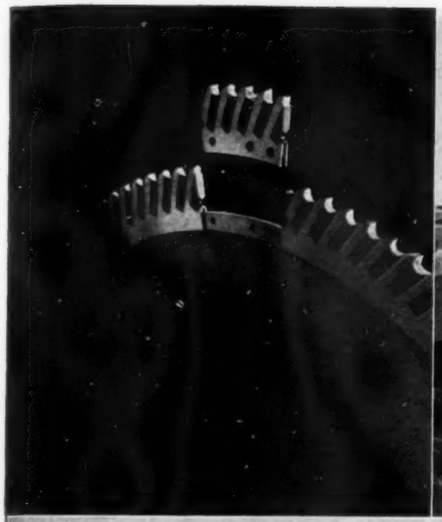
ERRINGTON
STAPLETON, STATEN ISLAND, N. Y.
MULTIPLE HEADS

Super-Sensitive Fixed Center Multiple Drilling Heads

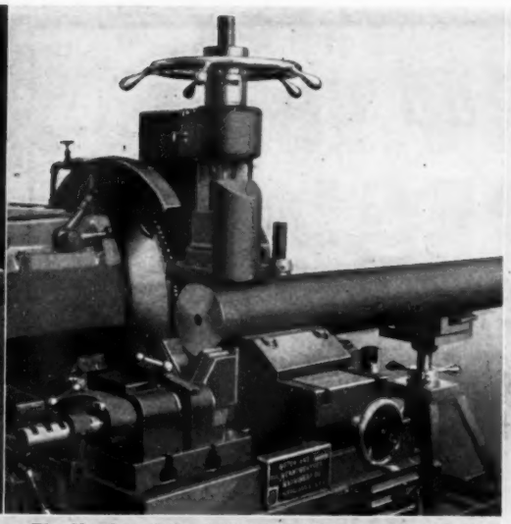
Fixed-Center Auto-Reverse Multiple Tapping Heads

All Parts Fully Enclosed to Insure Pressure Lubrication and Rigid Support of Adjustable Spindles

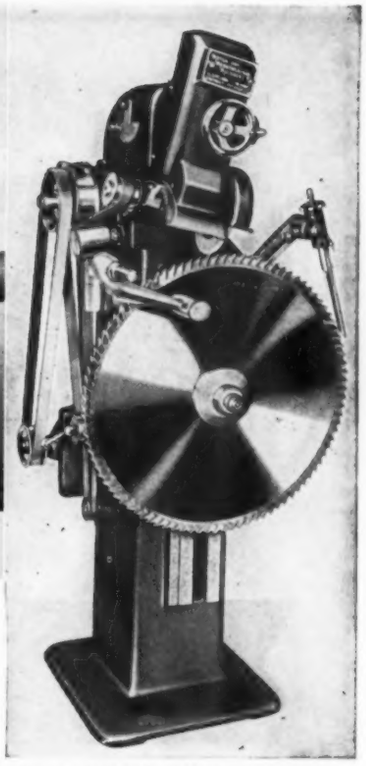
ADJUSTABLE MULTIPLE SPINDLE DRILLING HEAD



The Motch & Merryweather Saw Blade can be used on any standard cold sawing machine. Sizes: 26", 28", 30", 38", 42", 44".



The No. 3 and No. 4 Motch & Merryweather Cold Sawing Machines cut practically any metal — round stock up to 16" and square up to 14-1/2".



The M. & M. Saw Grinder sharpens all standard makes of blades. It gives correct tooth contour and long service.

Only MOTCH & MERRYWEATHER CAN GIVE YOU THE *COMPLETE* COLD SAWING COMBINATION

A manufacturer who builds three related pieces of equipment should do a better job for that reason. His knowledge of each machine promotes a more effective correlation. . . .

Watch the Motch & Merryweather Segmental Saw Blade flash through the work — rigidly, accurately, cleanly, delivering square sections without a burr. Notice the astonishing speed. Observe the absence of scrap.

Examine the blade closely — its design, fit, workmanship, finish. Study its materials. Record how long it lasts. See how rapidly and accurately its cutting edge is restored by the Motch & Merryweather Saw Grinder.

Great speed and accuracy no doubt account for the fact that the Motch & Merryweather Cold Sawing Combination has contributed much to the production of millions of shell slugs, gun barrels and like items of war material. And — *those qualities can best be imparted* to equipment *through a single responsibility.*

THE MOTCH & MERRYWEATHER MACHINERY COMPANY
Penton Building • Cleveland, Ohio

Built by **MOTCH & MERRYWEATHER**

MOTCH AND MERRYWEATHER THE MACHINERY CO
CLEVELAND CINCINNATI DETROIT PITTSBURGH

speed up
RE-DESIGN
with
REX *Flexible Metal Hose*

Units shown are typical Vari-formed Assemblies

● The physical adaptability of REX Flexible Metal Hose simplifies design and assembly problems alike. Almost every consideration of vibration, movement, alignment, saving of space and saving of weight in fluid handling problems points to one or another of the many production types of REX Flexible Metal Hose.

REX Flexible Metal Hose can be bent to position by hand and coupled, in a fraction of the time required to fit a pipe connection. It is readily snaked into place and secured without intermediate joints or elbows, in complicated installations where multiple turns exist in several planes. There is a type of REX Flexible Metal Hose designed to give superior performance under almost any operating conditions. In addition, experienced Chicago Metal Hose engineers are available to work with you on special problems when required.

USE OUR PRODUCT DIVERSITY TO SPEED YOUR PRODUCT DESIGN

REX-WELD Corrugated Flexible Metal Hose. REX-TUBE Interlocked Flexible Metal Hose. REX-FLEX Stainless Steel Flexible Tubing. AVIOFLEX Oil Line Hose. CELLU-LINED Hydraulic Hose.

CHICAGO METAL HOSE CORPORATION

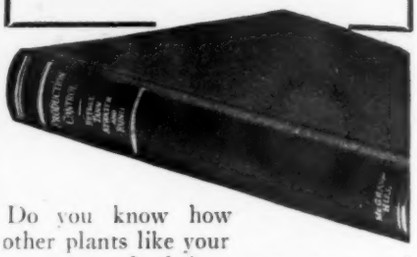
***General Offices:* MAYWOOD, ILLINOIS**

Factories: Maywood and Elgin, Ill.

GET MORE VOLUME

quicker—
—cheaper—

through modern production planning and control methods



Do you know how other plants like your own control their procurement and storage of materials—routing of operations—dispatching? How they control quality and inventory—what production records they keep—how they follow up details? Here is a book written out of actual industrial practice today, that tells you specifically and in detail.

Bethel, Tann, Atwater and Rung's

PRODUCTION CONTROL

Price, only $2.75

Tremendous pressure on industrial plants today means just one thing—better planning and control methods. This book grew out of a survey of current factory methods in 185 representative companies in all types of industry. It offers you complete analysis and discussion of planning and control, the fundamentals involved, case histories to illustrate applications, library of good control forms, etc. See what valuable suggestions and ideas you can get to apply to your own problems. Send for a copy today.

Look up in this book:

—the discussion of the 4 basic factors in forecasting production volume
—the explanation of the 3 types of budgets
—the treatment of the cycle of production planning
—the examples of purchasing and stores records
—the routing charts
—the example of a master control schedule
—the discussion of planning boards
—the study of when, where, and how much to inspect, etc., etc.

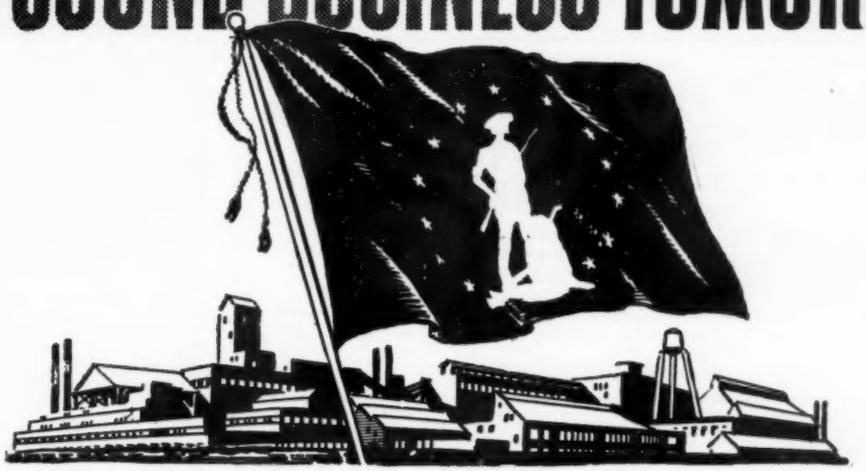
Send this coupon today for

10 DAYS' FREE EXAMINATION

McGRAW-HILL BOOK CO., 330 W.42nd St.,N.Y..C.
Send me Bethel, Tann, Atwater and Rung—Production Control for 10 days' examination on approval. In 10 days I will send you $2.75 plus few cents postage or return book postpaid. (Postage paid on cash orders.)

Name .....
Address .....
City and State.....
Position .....
Company ..... F.A. 10-1-42

FOR VICTORY TODAY
AND SOUND BUSINESS TOMORROW



Get This Flag Flying Now!

This War Savings Flag which flies today over companies, large and small, all across the land means *business.* It means, first, that 10% of the company's gross pay roll is being invested in War Bonds by the workers voluntarily.

It also means that the employees of all these companies are doing their part for Victory . . . by helping to buy the guns, tanks, and planes that America and her allies *must* have to win.

It means that billions of dollars are being diverted from "bidding" for the constantly shrinking stock of goods available, thus putting a brake on inflation. And it means that billions of dollars will be held in readiness for post-war readjustment.

Think what 10% of the national income, saved in War Bonds now, month after month, can buy when the war ends!

For Victory today . . . and prosperity *tomorrow,* keep the War Bond Pay-roll Savings Plan rolling in *your* firm. Get that flag flying now! Your State War Savings Staff Administrator will gladly explain how you may do so.

If your firm has not already installed the Payroll Savings Plan, *now is the time to do so.* For full details, plus samples of result-getting literature and promotional helps, write or wire: War Savings Staff, Section F, Treasury Department, 709 Twelfth Street NW., Washington, D. C.

Save With
War Savings Bonds

This Space Is a Contribution to America's All-Out War Program by

AMERICAN MACHINIST

CONTRACT WORK

Advertisements on this and the following page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

MACHINES AND PARTS,
SPECIAL TOOLS, ETC.
to your specifications

SPECIAL ENGINEERING WORK
. . . on Contract

It will pay you to investigate our facilities. As designers and builders of wire and ribbon stock forming machines we can offer you skilled and experienced assistance. Send us your blueprints or samples for prompt quotations.

We also solicit your bids for cam milling

THE A. H. NILSON MACHINE CO. Bridgeport, Conn.

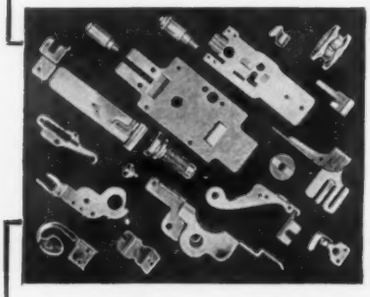
SPUR GEAR AND SPROCKET CUTTING

Have three automatic machines available—range 1" to 6' diameter.

OHMSTEDE MACHINE WORKS
897-899 N. Main St. Beaumont, Texas

Designers and Builders of Jigs, Fixtures and Small Tools.
Also Manufacturers of Automatic Turret Head for 10 inch Lathes.
Complete Details upon Request
GAS MODEL RESEARCH CO.
21 Market St. Rockville, Conn.

STAMPINGS AND ASSEMBLIES
Fast Service on Long or Short Runs



"GREATER SAVINGS WITH GREIST"

We can handle your stamping and assembly requirements in any metal. Our modern equipment and methods coupled with 50 years of experience is your guarantee of accuracy and efficiency. Our facilities include capacity for handling screw machine products, tools, dies, jigs and fixtures.

Quality work by skilled mechanics is assured. Send your blueprints or samples today for prompt quotations!

THE GREIST MFG. CO.
546 BLAKE ST. NEW HAVEN, CONN.

BRAZING HYDROGEN ELECTRIC FURNACE PROCESS
MODERN CONTINUOUS HIGH PRODUCTION EQUIPMENT
ALSO—BRIGHT ANNEALING
THE QUEEN CITY STEEL TREATING CO.
CINCINNATI, OHIO

COMMERCIAL HEAT TREATING
Seasoning of Steel, Nitriding
Centerless, Broach, Thread Grinding
Magnaflux & Optical Testing
Metallurgical & Chemical Laboratories
AGERSTRAND CORPORATION
Muskegon, Michigan

WORK WANTED FOR
LATHES
HAND SCREW MACHINES
MARYLAND MACHINE CO.
5213 Reisterstown Rd., Baltimore, Maryland

MACHINE SHOP WANTS DEFENSE WORK

Lathes, Milling Machines, Drill Presses, Riveting, Hot Dip Tinning, Jigs and Fixtures. Investigate TODAY.

STEPHEN J. LEWIS ENGINEERING CO.
215 Butler St. Triangle 5-5848 Brooklyn, N. Y.

Gray Iron and Semi Steel Castings, also alloyed with nickel, chrome, and molybdenum. Wood, Iron, Brass and Aluminum pattern work.

KING FOUNDRIES, INC.
Phone 823 North Wales, Montg. Co., Pa.
22 Miles from Philadelphia, Pennsylvania

CAPACITY AVAILABLE
FOR
THREAD MILLING WORK
Write
Box 331 American Machinist
330 West 42nd St., N. Y. C.

MACHINE SHOP

Facilities include 9" South Bend Bench Lathe, #2 Brown & Sharpe Milling Machine, Drill Press and 8"x8" Shaper. The usual line of hand tools and equipment plus experienced workmenship assure your satisfaction. Your inquiries invited.

C. VANDEGRIFT CO.
HOCKESSIN DELAWARE

PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY
Put your pattern problems up to us—we will take care of them—ask the foundries about our work—they use our patterns every day.
GENERAL PATTERN WORKS
2233 Buck Street Cincinnati, Ohio

MODERN MACHINE SHOP
Wants subcontracts for small precision lathe and grinding work with tolerances up to .0002" (cartridge punches, shafts, etc.) 30 Machines available.
PRECISION PARTS, INC.
17 THOMPSON ST., N. Y. C.
WAlker 5-5518

WORK WANTED FOR
Cylindrical Grinder 10"x54", Horizontal Boring Mill 2½" bar, Lathes, Milling Machines, Shapers, Drill Presses, Hand Screw Machines, Foot and Power Presses, Bench.
HAIDA ENGINEERING CO.
34-11 Vernon Blvd. Long Island City, N. Y.

WIRE AND METAL SPECIALTIES
In round, flat, square and special shaped wire in all metals.
LARGE PRODUCTION CAPACITY
Plating and finishing.
EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

We need sources for machining castings and outside screw machine capacity.
—A New York Concern

I want sources for instruments and parts.
—Chief Engineer, Washington Bureau

These are only two of the many inquiries received by our Contract Work Department from readers who could not find what they wanted advertised in the Section. This typifies the opportunities opened to you through advertising in these pages.

CONTRACT WORK

Advertisements on this and the preceding page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

KIRK & BLUM

CONTRACT MANUFACTURING
ACCURATE SHEET STEEL
STAINLESS STEEL, MONEL OR
OTHER ALLOY FABRICATION
OUR SPECIALTY
CAPACITY 3/8" AND LIGHTER

THE KIRK & BLUM MFG. CO.
2823 SPRING GROVE AVE. CINCINNATI, OHIO

THE NORLIPP COMPANY

Engineers . . . Manufacturers

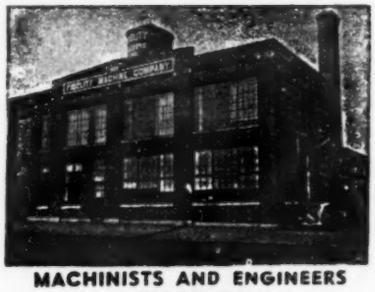
Sub-contract facilities for die castings and metal stampings
556 West Congress Street Chicago, Illinois

GAGES—PUNCHES—DIES—ETC.
HEAT TREATING FACILITIES

BARTON MACHINE & TOOL CO.

PRECISION TOOL MAKERS

14 Taft Street Pawtucket, R. I.



MACHINISTS AND ENGINEERS
FIDELITY
MACHINE COMPANY
3908-18 Frankford Ave. Phila., Pa.
Jefferson 7600-1-2

GEST ENGINEERING & EQUIPMENT CO.

Ordnance and Defense Plant Equipment
Industrial Engineers
Jigs, Fixtures, Gages and Special Mach.
31 East, Georgia St. Indianapolis, Ind.

METAL STAMPINGS

• TOOLS • DIES •

PERMANENT MAGNETS

HEAT TREATING

THOMAS & SKINNER
STEEL PRODUCTS CO.
1103 E. 23rd St. INDIANAPOLIS, IND.

Our Grey Iron Foundry, Structural and Machine Shops are at your disposal

for

Medium Heavy

SPECIAL MACHINERY

CONTRACT WORK SOLICITED

ROBT. HOLMES & BROS., INC.
JUNCTION AVE. DANVILLE, ILL.

QUALITY

SCREW MACHINE
PRODUCTS

• ● •

WALTHAM
SCREW COMPANY
WALTHAM • MASS.

PUNCHINGS
STAMPINGS
ASSEMBLIES

Quick action on your problem! Use our manufacturing facilities as your branch factory. Well-equipped for small and medium-sized work. Investigate time-saving possibilities *today!* Send prints or samples.

M & M MANUFACTURING CORP.
FORTVILLE, INDIANA

SUB-CONTRACT FACILITIES FOR

Hand screw machine products.

Engine and bench lathe, milling and drill press work.

Small sheet metal fabrications to closer than commercial tolerances.

Stampings.

We do our own tooling.

RELIANCE MACHINE & MFG. CO.
Thirty Irving Place New York City
36 years experience in metal fabrication.

Need steel balls

for defense assemblies ?

The Abbott Ball Company
1042 New Britain Ave., Hartford, Conn.

ABBOTT BEARING BALLS

DESIGNERS OF
Jigs, Fixtures & Dies
Prompt Service

LAWRENCE W. SECREST CO.
P. O. Box 265
Alexandria Virginia

DESIGN & BUILD
JIGS, FIXTURES & GAGES

REED MACHINE & TOOL ENG.
BOX 662
PAWTUCKET, R. I.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.
(See ¶ on Box Numbers.)
POSITIONS WANTED (full or part-time salaried employment only), ½ above rates.
PROPOSALS. 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.
DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH

The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns — 30 inches—to a page. A.M.

NEW ADVERTISEMENTS received by 10 A.M., October 5th will appear in the issue of October 15th, subject to limitations of space available

KEY MEN WANTED

Engine Manufacturer established in 1870 and now 100% in war production is seeking additional men of high caliber and proved records for prominent positions to perpetuate and build for the future.

1. **CHIEF ENGINEER** with Diesel experience to design and improve so as to reduce manufacturing costs of the present small Diesel Engines and Dieselectric plants 4 to 20 H.P.—3 to 15 KVA.
2. **PRODUCTION MANAGER** to plan, organize, schedule and synchronize the flow of parts for mass production and prepare for a much greater output.

Above men are not to replace present employees but are necessary additions to round out our present organization to meet peace time conditions. Men chosen when found satisfactory may become stockholders. When writing please designate the position you are qualified for.

WITTE ENGINE WORKS
1601 Oakland Kansas City, Mo.

POSITIONS VACANT

These Positions Vacant advertisements are published subject to agreement by the advertisers not to consider applicants now employed on war work unless they obtain written release from present employer.

WANTED—By large organization, man or woman familiar with leading companies in machinery industry, and able to undertake analytical work. Must be able to write clearly and concisely for publication. Reply should outline applicant's age, education, experience, number dependents and salary desired. P-336, American Machinist, 330 W. 42nd St., New York, N. Y.

WANTED—MACHINE TOOL Sales Engineer thoroughly familiar with tooling of turret lathes. Permanent position. State experience. P-328, American Machinist, 330 W. 42nd St., New York, N. Y.

PRODUCTION MANAGER. For Eastern die casting plant. Must have die casting experience and ability to take full charge and supervise production methods and personnel. The man who can get results from this plant, will receive adequate compensation. Reply fully stating experience and salary expected. Box #444, 1457 Broadway, Suite 617, NYC.

PROJECT ENGINEER—To fill position covering engineering contacts, experimental development work, and miscellaneous mechanical and electrical accessories in the aircraft field. Engineering school and practical experience background. Must have draft deferment and not presently employed in war industry. Titeflex Metal Hose Co., 500 Frelinghuysen Avenue, Newark, N. J.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 32 years recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo, N. Y.

MACHINIST TO OVERHAUL AND REPAIR MACHINE TOOLS. ALSO MAKE JIGS AND FIXTURES. PERMANENT POSITIONS. GOOD WORKING AND LIVING CONDITIONS. OPEN SHOP. FIFTY HOUR WEEK. $1.25 PER HOUR. STATE AGE, EXPERIENCE AND DRAFT CLASSIFICATION.

Address P-327, American Machinist
520 No. Michigan Ave., Chicago, Ill.

Assistant General Foreman wanted

for scraping, fitting, assembling departments, Machine Tool Plant. Preferably under 45 years of age. Must be capable of directing work, know how to handle men, and be qualified to introduce improvements. Location New Jersey. State Qualifications, Nationality, salary expected in first letter.

P-317, American Machinist
330 West 42nd St., New York City

EMPLOYMENT SERVICE

Manufacturing Executives and Technical Men, chemists and metallurgists immediate openings throughout country. Salaries $2500 to $20,000 year. Write for application. Confidential. Established 27 years. Harrison Personnel Service, 20 W. Jackson, Chicago.

POSITIONS WANTED

FACTORY MANAGER or superintendent Automatic Screw Machine and small to medium precision parts, thirty years experience all phases of above types of work. Available October 1st. Salary open. PW-314, American Machinist, 520 N. Michigan Ave., Chicago, Ill.

MANUFACTURING EXECUTIVE: Age 45, Graduate M.E., Twenty-eight years experience in machine shop, supervision, production, engineering, and management, desires position about October 1st in executive capacity. PW-326, American Machinist, 330 W. 42nd St., New York, N. Y.

SELLING OPPORTUNITIES
OFFERED—WANTED
Selling Agencies—Sales Executives
Salesmen—Additional Lines

REPRESENTATIVE WANTED

REPRESENTATIVES WANTED for Gauge manufacturer—(Plug Gauges heat treated and Hard Chromium Plated) new and reconditioning—quick deliveries. Few territories still open. Only efficient and introduced concern or persons with experience and references need apply. RW-329, American Machinist, 330 W. 42nd St., New York, N. Y.

PROFESSIONAL SERVICES

MORRIS AND VAN WORMER
Est. 1924
Industrial Engineers
WAR PRODUCTION
METHODS — DESIGN — QUALITY
PLANT LAYOUT — CONVERSION
25 Broad Street New York City

PATENT ATTORNEYS

PATENTS—Booklet free. Highest references. Best results. Watson E. Coleman, Patent Lawyer. 724 Ninth Street, Washington, D. C.

PATENTS, COPYRIGHTS. Booklet. "General Information Concerning Inventions and Patents" and "Fee Schedule" sent without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington, D. C.

CONTRACT WORK

WORK WANTED — For advertisements of work wanted see names indexed under Contract Work in the Searchlight Section Index appearing on the page Facing the inside back cover.

MANUFACTURING PLANTS WANTED

Clients with unlimited capital desire to purchase plants now engaged in war work. Confidential service. No publicity.

BUSINESS BROKERS, INC.
120 S. La Salle Chicago, Ill.

WANTED

Help Hurry Victory!

The difference between a bottleneck and a production record may lie in that forgotten or unused machine in your plant. Don't let it lay idle. We will purchase for rebuilding and resale the outcast tools you may have that are needed so badly by other defense plants.

Immediate cash paid for all equipment purchased.

ATLAS EQUIPMENT COMPANY
101 S. Clinton St. CHICAGO, Ill.
Randolph: 7017

WANTED
MILLING MACHINES

Five **Brown and Sharpe** Number 1 Y Milling Machines—used or rebuilt—in good condition.

Write Purchasing Agent,
Eastman Kodak Company,
Hawk-Eye Works
1447 St. Paul Street Rochester, New York

NEW INVENTIONS WANTED

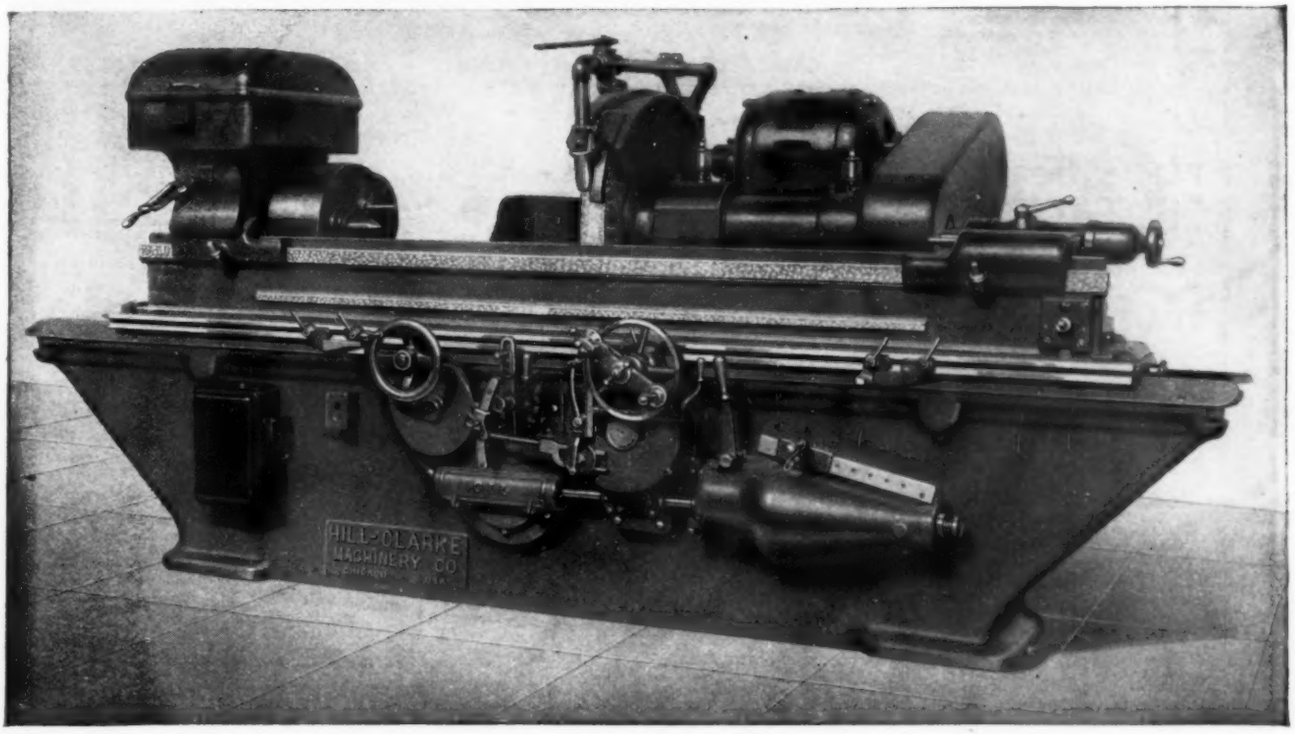
Mechanical and electrical devices which can be used to promote our war production program. Either new ideas, or improvements upon present methods.

P. O. Box 217, Denville, N. J.

Rebuilding Service—See Pages 217, 218, 221, 226

Additional Wanted Ad, Page 221

Yours for Super Grinding!



HILL-CLARKE MODERNIZED CYLINDRICAL GRINDERS

give you a finish within a few micro-inches even when using standard grain free-cutting wheels. Contributing to this achievement is a patented multiple V-belt drive from a constant speed motor to the work spindle.

Throughout the machines there are refinements in design, fitting of components, minimized vibration which make possible extreme accuracy in all grinding operations. An accurately fitted wheel slide with cross feed screw mounted in ball bearings provides sensitive wheel control essential to duplicate work within close limits. For complete information, write for our illustrated catalog "Super Grinding."

SIZES

10 x 36	14 x 36	14 x 72	16 x 72
10 x 50	14 x 50	16 x 50	18-30 x 96

HILL-CLARKE MACHINERY CO.

651 WASHINGTON BOULEVARD, CHICAGO

SEARCHLIGHT SECTION

AUTOMATICS

1" **Cleveland** Model J Double end.
No. 454 **Gridley.**
4½" **Gridley** Model H.
No. 33 **New Britain.**
No. 16 **Gisholt.**
1"x18" **Pratt & Whitney** automatic lathes.
5" **Bullard** 4 spindle "Vert-au-matic".
6" **Baird** Model B 6 spindle.
6"x6¾" **Goss & Deleeuw.**
14"x19" **Fay.**
Edlund Model SP-107 automatic.

GEARS

No. 18H **Gould & Eberhardt** universal gear hobber.
8"x10" **No. 1 Lees Bradner** production hobber.
14"x8" **No. 5A Lees Bradner** universal hobbers.
26"x8" **No. 3 Brown & Sharpe** auto spur.
36"x6" **Gould & Eberhardt** spur gear cutter.
48"x10" **No. 4 Brown & Sharpe automatic spur.**
Gleason circular finishing cutters, without blades.
National Tool Co. (Cleveland) Model B gear and gear shaper cutter checking machines.
Lipe gear tooth chamfering machine, double spindle.
No. 3 **Barber Colman** gear hobber.
18" **Gleason** bevel gear generator.
Nos. 60, 61 & 62 **Fellows.**
Gleason gear roughers.
Gleason gear testers.
Gleason gear lappers.

LATHES, ENGINE, TURRET & PRODUCTION

11" 3' **South Bend** Model 8Y.
22"x10' **American** with hex turret.
No. 2 Southworth.
2" spindle **Jones & Lamson.**
No. 2 **Warner & Swasey.**
No. 4 **Warner & Swasey.**
No. 3 **Wood Tilted Turret.**
3"x36" (14½" swing) **Jones & Lamson,** cross feeding headstock.
22" **Steinle.**
36" **Libby.**
28" **Steinle.**

BROACHES

No. 1 **La Pointe,** screw type.
No. 2 **Standard** screw type broaching press.
No. 3 **LaPointe of Hudson,** screw type.
No. 3 **J. N. LaPointe** double screw type.
No. 3 **American** high speed, rack type.
No. 4 **LaPointe.**

GRINDERS, CYLINDRICAL, PLAIN AND UNIVERSAL

10"x24" **Norton.**
10"x24" **Landis.**
12"x30" **Fitchburg.**
10"x36" **Norton.**
10"x36" **Cincinnati.**
10"x50" **Norton.**
12"x36" **Landis** self contained.
18"x72" **Landis Walker** 8" dia. chuck surface.
No. 5 **Bridgeport** tool.
Gisholt tool grinder for lathe, planer or shaper tools.
24" **Ingersoll** tub type face milling cutter grinder.
2¼" **Wilmarth & Morman** drill grinder, belt drive.
18" **No. 2 Gardner** double end disc grinder.
18" **Gardner** semi-automatic disc grinder.
24" **No. 4 Gardner** double end disc grinder.
24" **No. 84 Gardner,** opposed discs, V-belt motor drive.
53" **No. 24 Gardner** horizontal disc grinder with motor.
5"x7" **Pratt & Whitney** worm or thread grinder cam feed type.
Hutto honing machine, type MD. Capacity holes 1" to 6" (Diameter, up to 12¼" deep.)
No. 15A Bryant internal grinder (hole and face grinder).
No. 6 Bryant internal grinder.
No. 12 Greenfield internal.
No. 50 Heald hydraulic cylinder grinder.
No. 60 Heald cylinder grinder.
Type 15 **Norton** vertical lapping machine.
No. 575 Hawes continuous rod and tube polisher, centerless feed.
10"x50" **Norton** cam shaft grinder.
17"x36"-48" **Norton,** Type B, Model 84 hydraulic crankpin grinders.
16"x4" **Norton** style D snagging grinder.
30"x4" **No. 41 Ransom** snagging grinder, double end, motor on spindle.

LATHES, PRODUCTION

1"x18" **Pratt & Whitney** automatic.
9"x14" **Porter Cable.**
13"x18" **Adams "Short Cut".**
13"x6' Automatic threading lathes, geared head.
20"x8' **Wickes** 12-speed geared head rapid production.
Three **Gisholt** Simplimatics.
Melling 4-cylinder camshaft lathe.
Melling 6-cylinder crankshaft lathe.
13"x20" **Seneca Falls** Model B.
14"x32" **Acme Model** No. 2.
28"x15' **Bridgeport** axle lathe.

MILLERS, PLAIN, VERTICAL AND MISCELLANEOUS

12" **Cincinnati** plain Mfg.
No. 12 **Brown & Sharpe,** plain Mfg.
Taft Pierce type A internal thread mill.
Model AB **Becker** Vertical, 10¾"x32¾" table.
36" **Niles** vertical car wheel boring machine.
No. 6 **Whitney** hand.
Nos. 1 & 1A **Davis & Thompson** drum type continuous.
Nos. 10 & 45 **Bilton** Productomatic.
2½" **Lucas.**
4⅞" **Berman & Smith.**
5" **Barrett** cylinder borer.

SHEARS, SHEET METAL AND WIRE MACHINERY

No. 1 **Hilks & Jones** alligator shear, capacity 1¼" round, 4"x1" flat, blades 12" long. 10" blades.
Lewis alligator shear, 16" blades.
Newbold guillotine shear, 2" capy.
No. 15 **Stanley** uni-shear with motor, 14-ga. capy.
18" **Pels** all steel beam shear.
4'x¼" Series 40-4 **Cincinnati** press brake.
12'x10 ga. Geo. A. Ohl press brake.
Nos. 1 and 2M **Pettingell** bumping hammers.
No. 3 RH **Magee** wiring machine.
⅜"x3' **Shuster** wire straightener and cutter.
⅝"x5' **Shuster** wire straightener and cutter.
Sleeper & Hartley coiling machines.
Sleeper & Hartley heavy coiling machine.
No. 225A **Bliss** slitter.
Bay City bending rolls.
No. 352 **Toledo** bending rolls.
"Thread Rolling" horizontal thread roller.
Mail Us Your List of Surplus Tools.

MILES MACHINERY CO. - - - Saginaw, Mich.

USED MACHINERY DEALER HELPS WIN WAR . . .

by keeping his eyes peeled . . . his ears to the ground . . . to detect and procure idle Machinery for War Work. Not an easy job in itself, yet he doesn't stop there. He burns telegraph and telephone lines to find idle machinery . . . then with his facilities rebuilds this Machinery so that it can be put to work promptly.

O'BRIEN OF PHILADELPHIA KNOWS HOW!!

That briefly is what we have been doing since the outbreak of the War *and for more than a quarter century before it.* Our entire organization and facilities are hard at work securing, rebuilding, and placing machinery for vital war needs. Finding employment for idle machinery for vital war needs. Finding employment for idle machinery on hand puts Victory into production faster than building new machinery. Because it contributes to Victory, it's a job of which we're proud.

As a result of our 27 years experience we now have on hand, not yet allocated, some very desireable MACHINE TOOLS and EQUIPMENT for the STEAM & ELECTRICAL POWER PLANT waiting to aid the war effort.

★ PARTIAL LISTING OF ITEMS IN STOCK, SUBJECT TO PRIOR SALE ★

BORING MILLS
62" Betts vert. belt drive, 2 heads.

GRINDERS
2—#1 Gardner hyd. face. mtr. dr. table 10x30.
12"x36" Pratt & Whitney, surface, belt drive.
2—#60 Heald Internal cyl. 12" & 15" spindles.

LATHES
24"—48"x12' McCabe, 2-spindle, belt drive.
26"x10' Crawford, motorized, quick change.
21"x8' LeBlond, belt drive. dbg. quick change, belt.
20"x14' Springfield, geared head, s.p.d. quick change.
18"x14' Hamilton, belt drive, quick change.
18"x8' Lodge & Shipley, belt drive. dbg.

TURRET LATHES
28" Bogart, belt drive, 4" hollow spindle, heavy duty.
24" Gisholt, mtr. dr. 2½" hollow spindle.
25"x10' LeBlond, heavy duty, mtzd. quick change hex. turret on cross slide.
3"x36" Jones & Lamson, geared head, collet chuck.
3½"x60" Fitchburg Lo-swing, single pulley drive.

DRILLS
2-spindle Henry & Wright bb. #3 M.T. 12. overhang.
6-spindle National Acme Horiz. Drill belt drive.
1-spindle Allen bb. #2 M.T. belt.
1-spindle Henry & Wright bb. belt.

MILLERS
5—Hand Milling Machines, tables 4x18.
#3 Lees Bradner Thread Miller, mtzd.
#8 Becker Duplex, belt drive, table 11x40.
#104 Newton slab planer type, table 14x54.

MISCELLANEOUS
#6 Cochrane Bly 24" Cold Saw, belt dr.

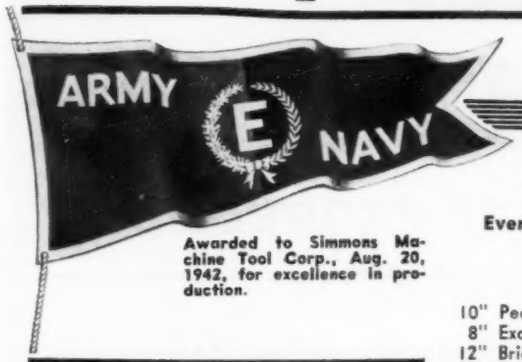
We are representatives in the Philadelphia area for many of the leading national manufacturers of new machinery

THE O'BRIEN MACHINERY CO.

"PHILADELPHIA'S LARGEST DEALERS IN MACHINERY AND EQUIPMENT"

113 NORTH THIRD STREET • PHILADELPHIA, PA.

TELEPHONE • MARKET 0727 CABLE ADDRESS • OBRIEN PHILA



Awarded to Simmons Machine Tool Corp., Aug. 20, 1942, for excellence in production.

IN STOCK

Every machine listed on this page is in our warehouse at press time.

MILLING MACHINE ATTACHMENTS

Kempsmith Slotting Attachment for 4" bar.
No. 2 Cincinnati Vertical Attachment—can also be used on No. 3-S for 4½" bar.
No. 3 Cinc. Vert. Hd., 4½" bar.
No. 4 Cincinnati Vertical Hd., for rectangular overarm.
No. 5 Cincinnati Vertical Hd., screw nose, 5¼" bar.
No. 4 Brown-Sharpe Rack Cutters—old type machine.
Slotting Attachment for No. 1½ K&T Miller.
Vertical Head for No. 1½ K&T Miller.
No. 2 K&T Vertical Head for Screw Nose.
No. 3 Kempsmith Vert. Hds.
Cincinnati Univ. Spiral Milling Machine att., 4½" bar.
Cincinnati Univ. Spiral Milling Machine att. 4¼" bar.
Cincinnati High Speed Univ. Vertical Head 4¼" bar.
12" and 14" Cincinnati Univ. Dividing Heads.
12" K&T Plain Dividing Hd.

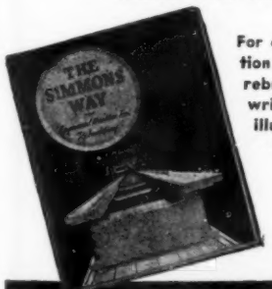
BORING MILLS

48" Putnam Car Wheel, facing attachment.
52" Betts Car Wheel, pneu. hoist.
Slotting Attach. for Vert. Mill.

DRILLS

30" Henry-Wright Sensitive Radial.
No. 3 Bement Two Spindle Gang. No. 5 Taper.
10" Signourney Sensitive.
One sprindle Avey H.S., B.B.
One Spdle. Henry Wright Class B.
No. 39 Natco Straight Line Multiple Spindle.
No. 12 Pratt & Whitney Rectangular Head.

WRITE FOR THIS BOOK



For a complete description of how Simmons rebuilds machine tools, write for this 58-page illustrated book, "The Simmons Way."

GRINDERS

10" Pedestal, belt drive.
8" Excelsior Pedestal belt drive.
12" Bridgeport D.C. Motor 230 v.
Webster Perk, polishing stand.
Beyer Peacock Vertical Internal.
14" P&W Surface, Verticle Spdle.
12" Besley Disc. S.P.D. No. 1.
10" Besley, Disc. S.P.D. No. 2.
22" Besley, Univ. Table No. 14.
24" Gardner Disc. No. 6.
18" 2-Spdl. Sizing Gardner, #120.
18" Besley Double Spindle, No. 26.

GEAR CUTTERS

24" Gleason Former, M.D.
22" Rhenania Hobber, S.P.D.
24"x9" G&E M.D.
36"x10" B&S Spur, No. 4.
60"x12" B&S Spur, No. 5.
50"x8" G&E Spur & Bevel.
90" P&W Spur & Worm.
6" Bilgrim Bevel Generator.
15" Gleason Bevel Planer.

LATHES

48" Tindell Morris Crankshaft, M.D.

MILLERS

Ingersoll Slabbing Cutters, 7" to 25" Wide.
No. 2 Sloan & Chase, Bench.
No. 9 Niles Vert. Rotary Table.
No. 10 Niles Vert. Rotary Table
30"x30"x10' Newton Slab.

PRESSES

Punches and Shears

Niagara Circle Shear 1/8"x18".
6"x6"x5/8" Angle Shear, M.D.
No. 202 Niagara Notching Press.
10 Ton Henry Wright Dieing.
20" Throat, H&J No. 00, ¾"x⅜"
42" Throat, L&A No. 2, 1"x1".
42" Throat, H&J No. 4, 1¾"x1".
42" Throat, H&J No. 2, 1"x⅞".
54" Throat, H&J No. 5, 1¾"x1⅛".
60" Thrt., L&A No. 250, 1¾"x1".
20" Throat, Cleveland Double End, 1"x1".
24" Throat, L&A D.E., ¾"x¾".
24" Throat, Cleveland D.E., 1"x1".
Schultze Norman Beam Shear, R.T. 40.
No. 3 Southwark Washer Press.
No. 1 L&A Multiple Punch 72".

SAWS

7" Cap. Cochrane Bly No. 5, M.D.
7" Cap. Newton Cold Saw, M.D.
Nutter Barnes Sharpener, 18".
Espen Lucas Sharpener, 66".

SLOTTERS

12" Sellers, M.D.
14" Putnam.
16" Sellers, M.D.
30" Baker, Draw Stroke.
60" Newton Portable.

MISCELLANEOUS

No. 60 Arlington-Curtis Double Blower.
12"x8' Ingersoll Rand.
No. 3 Manville Bolt Trimmer
8' Pexto Cornice Brake, hand, 18 ga.
18'x12 ga. Hyraulic Press Brake, Lamson.
No. 2 Stoever Pipe Bndr., 2" cap.
No.5 Roots Foundry Blower.
No. 1 Manville Cold Header.
8' H&J Flanging Clamp, screw.
1½" Ajax Header.
2" Acme Header.
West Hydraulic Tire Setter.
40,000 gallon Water Tower.
2" B&K Pipe Threader
4" B&K Pipe Threader
4" Landis Bolt Threader.
6" Bignall Keller Pipe Threader.
10" Standard Pipe Threader.
14" E.C.&B. Pipe Threader.
3¼"x12" Triplex—Pump 1500 lb. pres.
236 G.P.M. 60' Centrifugal.
1000 G.P.M. Steam Fire Pump.
30 Ton Hanna Rivetter, 59" gap.
No. 8 Gaterman Vert. Tapper, M.D.
4" Baker Vert. Tapper or Reamer.
16" Baker Vert. Tapper or Reamer.
Niagara Circle Shear 1/8"x18"

WOODWORKING

No. 3 Oliver Wood Trimmer.
No. 1 American Saw Bench.
American Variety Woodworker.
18" Rogers Jointer.
Fay Egan Lightening Sander.

R.R. SHOP TOOLS

48" Putnam Car Wheel Borer.
52" Betts Car Wheel Borer.
Set of Locomotive Cyl. Chucks.
Bridgeford Journal Trueing, M.D.
42" Putnam Car Wheel Lathe.
42" Niles Car Wheel Lathe, No. 1.
48" Niles Car Wheel Lathe.
85" Putnam Driving Wheel Lathe.

THREADING MACHINES

2" B&K Pipe, Landis Head.
2" B&K Motor Drive with motor.
4" B&K Landis Head and cutoff.
4" Landis with cutoff.
14" E.C.&B., S.P.D.

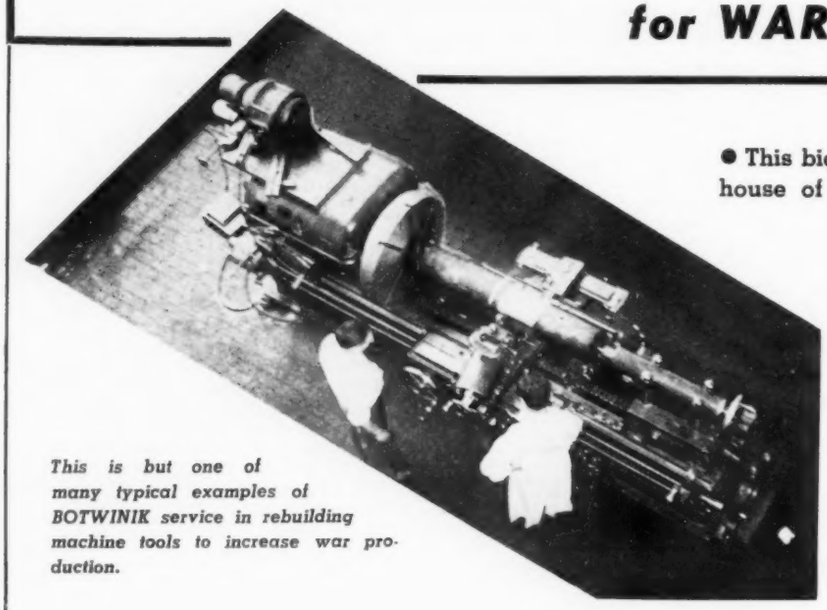
SIMMONS ENGINEERED Machine Tool REBUILDING

SIMMONS MACHINE TOOL CORPORATION

***Main Office and Plant:* 1759 N. BROADWAY, ALBANY, N. Y.**
***N. Y. OFFICE:* 149 BROADWAY**

BOTWINIK REBUILDS

for WAR PRODUCTION



This is but one of many typical examples of BOTWINIK service in rebuilding machine tools to increase war production.

● This big lathe was lying idle in the warehouse of a large manufacturing plant because it was not considered serviceable. However, it was shipped to the BOTWINIK plant, dismantled, and completely rebuilt. It was then returned to its owner and placed on the production line.

Today this lathe is busy working twenty-four hours a day, seven days a week on important war work. BOTWINIK rebuilding made this possible.

BOTWINIK BROTHERS, INC., 373 WELTON STREET NEW HAVEN, CONN.

YOU MUST HELP DEFENSE!!

SELL YOUR SURPLUS IDLE MACHINES THAT YOU ARE NOT USING! TURN THEM INTO CASH AND

BUY WAR BONDS!

IF YOU ARE DOING WAR WORK

AND YOUR MACHINES ARE NOT IN GOOD CONDITION, LET US REBUILD THEM FOR YOU IN OUR REBUILDING DEPARTMENT

OUR YEARS OF EXPERIENCE ARE AT YOUR SERVICE

A WORN OUT MACHINE WILL LEAVE OUR SHOP AS GOOD AS NEW

YOU ARE INVITED TO INSPECT OUR SHOP

H. LEACH MACHINERY CO.

387 CHARLES STREET DEXTER 0695 PROVIDENCE, R. I.

EVERY MACHINE IN STOCK!

CHUCKERS & SCREW MACHINES

2—6¾" Cleveland Single Spindle.
1—No. 19 B & S Automatic.
1—2⅝" Model G Gridley.
1—⅞" Model G Gridley.
2—No. 23 New Britain Chucking Machines.
1—No.23 Prentice Chucking Machine.

DRILLS & TAPPERS

1—6 Spindle Niles Rail Drill, No. 4 M.T.
1—2½' Fosdick Radial.
2—No. 12 Natco Multiple.
1—30" American Sliding Head Drill.
1—2 Way L. & G. Drill & Tapper.
1—3 Way L. & G. Drill & Tapper.
1—3 Way L & G. Multiple Drill.
1—Rockford 5-Spindle Hyd. Drill and Borer.
1—Simplex Greenlee Multi Horizontal Drill.
1—Single Spindle L. & G. Drill. 24" Hyd. Feed.
1—2 Spindle L. & G. Multiple Drill.
1—4 Spindle L. & G. Horizontal Drills.
2—4 Spindle Production Drills—No. 3 M.T.
1—6 Spindle L. & G. Horizontal Drills.
1—30" Barnes Upright Drill.
1—20" Single Spindle Cincinnati Drill Press.
1—Detroit 5 Spindle Horizontal Drill.
1—3 Spindle Reed Drill Press.
1—Barnes Universal Horiz. Drill, 2½" Spindle.
1—16" Fox Sensitive Drill.
1—No. 2BG Garvin Tapper.
1—Western 6 Spindle Multiple Drill, No. 3 M.T.

GEAR MACHINES

1—3 Spindle Gleason Bevel Gear Rougher.
2—18" Gleason Bevel Gear Generators.
1—36" Fellows Gear Shaper.
1—18" Gleason Bevel Gear Tester.

GRINDERS & LAPPERS

1—16"x80"Cincinnati Univ. M. D.
1—Cincinnati Brake Drum.
1—No. 3 Brown & Sharpe Tool.
3—No. 14 Gardner Opposed Disc.
1—8 Spindle Foote Burt Valve Grinder.
1—No. 6 Besly Double Disc Grinder—20" dia. discs.
1—Type P-4 Oliver Pedestal Die Filer.
1—12"x36" Modern Cyl. Grinder.
1—No. 65 Heald Grinder.
1—No. 1-F Norton Vertical Lapper.

HAMMERS

1—1100 lb. Erie Single Frame.
1— 800 lb. Bement Double Frame.
1— 600 lb. Erie Single Frame Forging Hammer.
1— 125 lb. No. 5 Power Hammer.

LATHES

1—16"x12' Greaves Klusman.
1—2¼"x24" Jones & Lamson Turret.
1—17"x8' Sidney.
2—Gisholt Simplimatics.
1—17"x6' LeBlond Engine Lathe.
7—20"x8' American Engine Lathes.
3—3½"x60" Lo-Swing Lathes.
1—42"x16' Putnam Lathe.
1—60"x20' Fifield Lathe.
1—12" Sundstrand Production.
1—20" Cincinnati Pulley.
1—No. 4 AC LeBlond Crankshaft Lathe.
4—19" LeBlond Universal Turret Lathes.

MILLERS

1—Nube Precision Die Sinker & Duplicator.
1—Newton 2 Spindle Profiler.
1—Taft-Pierce Thread Mill.
1—Holden-Morgan Thread Mill.
1—2 Spindle Ingersoll Openside Mill.

PRESSES

1—15 Ton Metalwood Hydraulic Pneumatic.
1—15 Ton Hercules Power Operated Arbor Press.
1—20 Ton Eastern Hydraulic Press.
1—Hannifin Arbor Press.
1—No. 64 Consolidated.
1—30 Ton Lucas Vertical Forcing Press.

SAWS

2—Higley Cold Saws.

MISCELLANEOUS

1—No. 3 Oilgear Hydr. Broach.
1—No. 1 P & H Horiz. Bor. Mill.
1—No. 0 Ajax Brake Shoe Key Forging Rolls.
2—1" Ajax Headers—cont. motion type—flywhl. dr.
1—No. 5½-B High Speed Riveter.
1—No. 10 Waterbury-Farrell Thread Roller.
1—No. 3 Thiel Die Filer.
1—2" National Bolt Cutter with Landis Head.
1—No. 3A High Speed Rivetting Hammer.
1—Toledo, 12 ft., 14 Gauge Power Shear.
1—2 Ton American Vertical Broach.
2—No. 3 LaPointe Broaches (screw type).
1—Teer, Wickwire Automatic Burr Cutter.
1—Type C Olsen Static & Dynamic Balancer.
1—No. 2 Mitts & Merrill Keyseater.
1—Coulter Automatic Threading Machine.
2—U. S. Eyelet Machines.
2—No. 156 Etna Swagers.
1—No. 1 La Pointe Broach.
1—Ajax No. 2 Bulldozer.
1—Reynolds Screw Driver.
2—No. 31 W-F Presses, Dial Feed.

MACHINE TOOLS
DONBERG D&D DANITS

MDNA MEMBER

WABASH 0123 **400 SOUTH CLINTON STREET** **CHICAGO**

MOREY
DEPENDABLE USED MACHINES

La POINTE No. 2 Broach
G. & E. 48" Gear Cutter
WHITON No. 15 Auto. Gear Cutter
FELLOWS No. 6 Gear Shaper
GLEASON 37" Bevel Gear Planer
GLEASON 10" Spiral Bevel Gear Generator
GLEASON 6"-11"-18" Bevel Gear Generators
HEALD No. 70A Duplex Internal Grinder
LANDIS 3½" Internal Hydraulic Race Grinder
NORTON 16"x50" Crankshaft Grinder—M.D.
HEALD No. 60 Internal Grinder
GARDNER No. 6 Dble. End BB Disc Grinder
P. & W. 6"x132" Thread Miller
AUTOMATIC MACHINE CO. 12x4' Threading Lathe
BRIDGEFORD 27"x10' Boring Lathe

NORTON 10x96 Plain Grinder —Arranged for motor drive, including motors

P. & W. No. 12 Multi-Spindle Drill
NATCO C-13 Hyd. Multiple Spindle Drill
NATCO C-11C Multiple Spindle Drill
BLISS No. 31 Power Press
ESPEN LUCAS No. 138 Cold Saw —Cap. 12" Rd.
NEWTON No. 197 & No. 200 Cold Saws
COCHRANE & BLY No. 5 Cold Saw
COULTER 2 spindle Diamond Borer—M.D.
LANDIS 4" Single Head Bolt Cutter
GRAY 30"x30"x8' Planer — 2 heads on cross rail—M.D.
ACME 1" All Steel Upsetter
AJAX 3" All Steel Upsetter
SAUNDERS 8"-18" Pipe Threader
TREADWELL 12" Pipe Machine
KELLER E3 Auto. Profiler (Die Sinker)
GISHOLT Precision Balancing Machine
LONG & ALSTATTER Double Angle Shears

THIS IS A PARTIAL LIST

• *Write us* •
your Specific Inquiries

MOREY MACHINERY CO., Inc.
[illegible] ST. NEW YORK

EASTERN OFFERS FROM STOCK

AIR COMPRESSORS
United States, m.d., with tank
Usaco, m.d. with tank
6x6" Curtis Vertical Twin Cylinder, m.d.
7x7" Curtis Vertical Twin Cylinder, m.d.

ARBOR PRESSES
King Screw Press, 36" between housings
Barnes Screw Press, 20" between housings
Barnes Screw Press, 13" between housings
15 ton Lucas High Pattern Power Forcing

AUTOMATICS
⅜-½" Cleveland Model B
⅞" Cleveland Model A
4 spindle ⅞" Cleveland Model M
No. 6D Potter & Johnston for brake drum work
No. 22 New Britain
No. 33 New Britain, m.d.

VERTICAL BORING MILLS
30" Colburn, 1 turret head
42" Niles Car Wheel Borer
48" Niles Car Wheel Borer

HORIZONTAL BORING MILLS
4" bar double Barrett
5" bar Newark
8" bar Barrett

BOLT THREADING MACHINES
¾" Style R Economy
9/16" 2 spindle Landis, m.d.
1" 2 spindle Acme Class A
1" 3 spindle Acme
1¼" American Bolt Header
No. 11S Rickert-Shafer Auto. Threading, m.d.
2½" Acme

BROACHING MACHINES
New Cincinnati Mill Broach
No. 1, 2, 3 LaPointe
No. 3 LaPointe Double

ENGINE LATHES
10"x5' Pratt & Whitney Toolmaker's taper, collet attach.
14x6' Davis & Egan
16" x8' Schumacher-Boye
16"x8' Perkins
16"x8' American
18" raised to 28"x10' Reed
18"x12' Barker
18"x16' Reed
20"x8' Fay-Scott
21"x12' Bradford
22"x13' Niles
22"x16' centers (22' bed) American 100 H.P. Input Super Lathe, with 100 H.P. D.C. variable speed motor and 6 smaller motors, p.r.t., chip conveyor, etc. Weight 65,000 lbs.
22"x18' Niles, taper
24"x11' Chard
24"x12' Pond
24"x14' Lodge & Shipley
24-48"x14' McCabe 2 in 1, var. speed m.d.
24"x28' LeBlond
26"x16' Betts-Bridgeford, taper
30"x16' Schumacher-Boye

TURRET LATHES AND SCREW MACHINES
No. 0 Brown & Sharpe Hand
3x36" Jones & Lamson, bar
3x36" Jones & Lamson, chucking
2 spindle 3x36" Jones & Lamson, chucking
1⅛x18" Pratt & Whitney Turret, bar equip.
1¼" Dreses Turret, bar equip.
Woods Tilted Turret

MANUFACTURING LATHES
3x80" Lo Swing
3½x36" Lo Swing
9x12" Sundstrand Mfg.
11"x4' Wells Speed
12"x5' Sebastion Geared Head Turning
14"x6' Champion Mfg.
15"x6' Automatic Threading
16"x6' Fulton Mfg.
16"x6' Rockford
18"x8' Chard
30" Streit Pulley Turning
Niles-Bement-Pond Axle Lathe
No. 5 Niles-Bement-Pond 42x96" Center Driving Car Wheel Lathe, new
Niles-Bement-Pond Quartering Machine, new

Many other machines in stock.
Send us your inquiries.

The EASTERN MACHINERY CO.
1004 TENNESSEE AVE.
CINCINNATI, OHIO

. . . IN STOCK

AUTOMATICS
¾" Gridley Model F, four spindle
1¼" Gridley Model F, four spindle
No. 515 National Acme, four spindle
No. 52 National Acme, four spindle

BROACHES
No. XB10 Oilgear Hydraulic Twin spindle
15 Ton Hercules Vertical

DRILLS
4' Prentice Radial
No. 1½ Foote Burt, 2 spindle
No. 15½ Foote Burt Fixed Center
No. 37 Natco Multiple Spindle
No. 1 Bausch, 8 spindle
Pratt & Whitney Gun Barrell, 2 spindle, m.d.

GEAR CUTTERS
No. 5 Cincinnati Automatic Gear Cutter
No. 3 Brown & Sharpe Automatic
No. 36 BM Gould & Eberhardt Rougher, three spindle
No. 6 Fellows Gear Shaper
96" Gleason Gear Planer
15" Gleason Spiral Bevel Generator
18" Gleason Gear Tester
No. 5A Lees-Bradner Gear Generator
No. 10 Lees-Bradner Gear Grinder
30" Rochester Gear Tooth Rounder

GRINDERS
6x18 Landis Cylindrical
10"x20" Landis Cylindrical hydraulic
18"x96" Brown & Sharpe Cylindrical
8" Heald Rotary Surface
No. 55 Heald Cylinder
No. 60 Heald Cylinder
No. 24—53" Gardner Disc.

LATHES
17"x8' Sidney, c.d.
24"x14' Reed Prentice, g.h.
24"x16' Whitcomb Blaisdel, c.d.
26"x14' Niles-Bement-Pond, c.d.
17"x8' Wickes Production, c.d.
3½"x60' Fitchburg Lo-Swing, g.h.

TURRET LATHES
No. 3A Warner & Swasey, g.h.
No. 6A Potter & Johnston, g.h.
3"x36" Jones & Lamson, g.h.
No. 9 Bardons & Oliver, c.d.

MILLS
No. 1 Milwaukee Manufacturing, s.p.d.
No. 5C Becker, Vertical
4" Bement Miles Horizontal Boring

MISCELLANEOUS
No. 3E Lees-Bradner Thread Miller, collet type
Wicaco Oil Groover
2" Pratt & Whitney Duplex Spline Mill
No. 1 Mitts & Merrill Keyseater
No. 253 Dreis & Krump Press Brake, m.d. (4)

PLANERS AND SHAPERS
54"x54"x16' Niles Bement Pond Planer, 4 heads
36"x36"x12' Niles Double End Planer
32"x32"x10' New Haven Planer
18" Lodge & Davis Shaper, c.d.
20" Rockford Shaper, c.d.
20" Wolcott Shaper, c.d.
24" Cincinnati Shaper, c.d.

TAPPERS
½" Rickert Shafer Radial

INDIANAPOLIS MACHINERY & SUPPLY CO., INC.
1959-69 South Meridian Street
INDIANAPOLIS, INDIANA
Eastern Branch:
44 WHITEHALL STREET, NEW YORK, N. Y.

One of the great untapped sources for scrap is your UNUSED SURPLUS machine tool collection

OUR GOVERNMENT IS IN DIRE NEED OF SCRAP MATERIALS OF ALL KINDS

The Machinery Dealers' National Association, in cooperation with the Industrial Salvage Section of the War Production Board, is making every effort to release as many machines that are unsaleable or in such poor condition that they do not lend themselves to rebuilding for release to the scrap drive.

There are many veteran machinery men who can tell at a glance which of the machines you have should be reserved for the production program, and those which are "cupola fodder".

This appeal is directed to the great body of intelligent patriotic American manufacturers who are aware of the disastrous effect of a continued scrap shortage on production schedule!

As machinery men, of course we do not wish to see unused productive capacity destroyed without a fair trial.

Solicit the opinion of a reliable used machinery dealer in your locality before you relegate a "production soldier" to the scrap heap.

This machine may have outlived its usefulness as far as you are concerned, but can be used for some other job or be rebuilt to restore it to its original use.

Act now—there is no time for indecision or delay!

We are anxious to cooperate with you in this vital program of either scrapping or putting in productive service every idle machine wherever located.

The members of the Machinery Dealers' National Association invite you to call on them at any time.

We are ready, willing and able to serve you.

All association members display the emblem of the association.

MDNA
MEMBER

WRITE FOR MEMBERSHIP LIST!

MACHINERY DEALERS' NATIONAL ASSOCIATION

20 N. WACKER DRIVE **CHICAGO, ILLINOIS**

PUT THESE IDLE MACHINES TO WORK!

Exceptional—"Hard-to-Find" Tools

In Stock ***Immediate Delivery***

Lucas 3" Bar Horizontal Boring Mill, Mtr. Drive

American 4' x 13" Column Radial Drill—Triple Purpose

Landis 10" x 36" (new 1936) Plain Grinder, 3 Motor Drive. All Hydraulic Feeds

Cincinnati #3 Plain Miller, old Style, Motorized

Vertical Boring Mill 72"—2 Swivel Heads

Hoosier Heavy Duty Drill all Geared Feeds

Natco 32 Spindle Multiple Drill

2 Fellows 36" Gear Shapers

Barber Colman #2 Gear Hobber, like new

100 other machines

SEND FOR 16 PAGE ILLUSTRATED CATALOGUE

HASCO Machinery Company

661-671 Frelinghuysen Ave., Newark, N. J.

H. I. SEGAL, *Gen'l Mgr.*
S. H. BERGER, *Sales Mgr.*

M-G-M PRESENTS

AIR COMPRESSOR
#10 Ingersoll-Rand Imperial 850 cu.ft. displacement 150 Horse Power Motor

AUTOMATICS
#2 Brown Sharpe Cut Off
#00 Turret Formers
1" x 18" Pratt & Whitney Automatic Lathe

DRILLS
44 Sp. Baush Multiple
36 Sp. Baush Multiple
4' Fosdick Radial
3 Sp. Henry & Wright

GEAR MACHINES
2—#12 Barber Coleman Single Overarm

LATHES
32" x 22' New Haven
1" x 18" Pratt & Whitney Automatic

MILLS
5C Becker Vertical Billings & Spencer Universal Die Sinker
24" Cinn Automatic
18" Cinn Automatic
#21 Brown & Sharpe Production S.P.D.

THREAD MILL
6" x 14" Pratt & Whitney Internal

TURRET LATHES
3" x 36" Jones & Lamson

MILLS-GAVAN MACHINERY SALES 3126 GRAND RIVER AVE. • TEL. TE. 1-3148 DETROIT, MICHIGAN

SPECIAL OFFERINGS

2—400 Ton Capacity **Hydraulic Presses**, 66" x 42" Cold Platens, 7'—5" Vertical Opening, 5200# Hydraulic Working Pressure, 30" Stroke of Ram.

1—400 Ton Capacity, 8 Opening **Hydraulic Press**, 52" x 30" Steel Steam Platens, 3" per Opening. Complete with Pump, Motor, Valves, Piping, to Make Complete Self-contained Unit.

Headquarters for Hydraulic Pumps, Presses, Accumulators, etc., in Varying Sizes and Capacities.

INDUSTRIAL EQUIPMENT CO.
856 Broad Street Newark, New Jersey

MISCELLANEOUS MACHINES

Rockford Sgl. End Hydr. Boring Machine with 2-sta. 54" dia. table.
6' Niles Pl. Radial Drill
No. 60 NATCO 3-Way Multiple Drill
4-Spdl. Henry & Wright H.S. Drill
Niagara Dbl. Seamer, t.&l. pulley dr.
10x10" Napier Metal Band Saw
½" Shuster Auto. Cut.&Straight. Machine

STRONG, CARLISLE & HAMMOND COMPANY
1392 West 3d St., Cleveland, Ohio
2832 E. Grand Blvd., Detroit, Mich.

AVAILABLE NOW

9/16—16 USF **Pratt & Whitney** Taps, High Speed; new.

75 HP **General Electric** Slip Ring Motor; 3 phase; 60 cycle; 440 volt; 645 rpm.

50 HP **Fairbanks-Morse** Induction Motor; 3 phase; 60 cycle; 440 volts; 514 rpm.

No. 22 **New Britain** Automatics; 4 spindles; 5 chucking positions; one spindle fixed for tapping; nice condition.

2 Spindle National Acme Bolt Threader; ⅝" capacity; excellent condition.

No. 3 **Mitts & Merrill** Keyseater; 2" capacity; box of tooling.

A. R. MARSH MACHINERY CO.
4900 W. 73rd St. Cleveland, Ohio

POWER PRESSES

BLISS, TOLEDO, V & O, ETC.
REBUILT — GUARANTEED

JOSEPH HYMAN & SONS
Tioga, Livingston and Almond Streets
Philadelphia, Pa.

10" **Merrell Pipe Machine**; with chasers; M.D.
#101 Production Centerless **Polish Machine**, M.D.
10' **Bausch** 2 spdle. Deep Hole **Driller**
#1 **Pratt Whitney** Duplex Thread **Hobber**
10'x¾" **Kling Bros. Bending Roll**, M.D.

HOWARTH MACHINERY CO.
1440 Franklin St. Detroit, Michigan

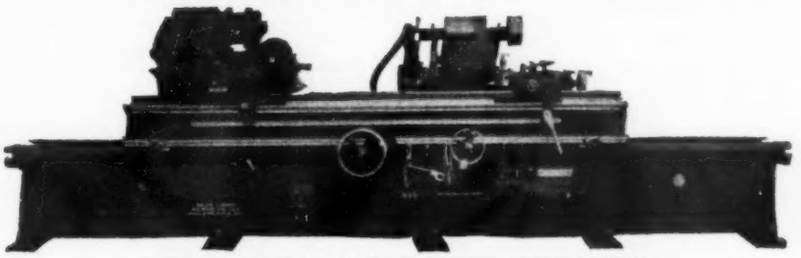
50 lb. **Beaudry Hammer**
40 lb. **William Hammer**
16"x32 **Bridgeport Automatic Threading Lathe**
10"x8" **Higley Power Saw**
24" **Becker Brainard Automatic Gear Cutter** for spur and bevel
Fisher Profile Grinder

INDUSTRIAL MACHINERY COMPANY
357 Dublin, Columbus, Ohio Adams 3534

Established 1867

HILL-CLARKE MACHINERY CO. CHICAGO U.S.A.

22"x96" NORTON PLAIN GRINDER



22"x96" NORTON PLAIN GRINDER, MOTOR DRIVE

DRILLS—Ball Bearing

No. 1—1 Spdl. Leland-Gifford.
1 Spdl. Henry & Wright.
2 Spdl. Henry & Wright.
4 Spdl. Sigourney (10).
4 Spdl. Woodward & Rogers.
4 Spdl. Henry & Wright (24).

GEAR CUTTERS

No. 60 BM Gould & Eberhardt Bevel Roughers (2).

GRINDERS

1½" Cap. "Yankee" Drill Grinder.
No. 40 Bryant Plunge Cut.
No. 60 Heald Cylinder.
No. 10 Lees-Bradner Spur Gear Grinder.

LATHES

No. 4—AC LeBlond Duplex Crankshaft.

SLOTTERS

10" Newton.

MISCELLANEOUS

No. 4 Gaterman Tapper.
2 Spdl. Baker Cyl. Borer.

HILL-CLARKE PLAIN CYLINDRICAL GRINDERS
See Advertisement on page 215

HILL-CLARKE MACHINERY CO.

651 WASHINGTON BOULEVARD **CHICAGO**

PHONE—WIRE—WRITE

YOUR REQUIREMENTS FOR USED & REBUILT MACHINE TOOLS

Lathes	Planers	Grinders	Drill Presses	Slotters
Milling Machines	Shapers	Radial Drills	Punch Presses	Gear Cutters

FALK MACHINERY CO.

18 WARD ST. TEL. MAIN 6347 **ROCHESTER, N. Y.**

What Tools Have You For Sale?

NEW ENGLAND HEADQUARTERS FOR MODERN MACHINE TOOLS
(THE SUPREME MACHINES OF INDUSTRY)
GENERAL MACHINERY CORPORATION
"THE MACHINE TOOL MERCHANTS"
John P. Tierney, Manager
140 FEDERAL STREET, BOSTON, MASSACHUSETTS TELEPHONE: LIBERTY 4826

BORING MILLS:

42" Colburn Vertical boring mill
48" Niles Bement Ver. boring mill
72" Rogers Vertical boring mill

TURRET LATHES:

2¼x24" Jones & Lamson Geared Head
3"x36" Jones & Lamson Geared head
1" Warner & Swasey Hand screw machines (2)

GRINDERS:

12" Pratt & Whitney Vertical surface grinder
14" Pratt & Whitney Vertical surface grinder
#60 Heald Internal grinder
#2 Walker Universal tool & cutter grinder
#3 Modern Cylindrical grinders
Fitchburg cylindrical grinder

DRILLS:

36" Putnam Drill Press
18" American Tool Wks. Combination drilling, milling and boring machine
5' Cincinnati Radial drill

LATHES:

16"x6' Hendey Lathe, Q.C. Taper attach.
16"x6' Flather Lathe
22"x10' Hamilton lathe, geared head
28"x12' Schumacher Boye q.c. lathe
32"x16' Putnam Lathe

SHAPERS:

16" Stepdoe
18" to 24" shapers (several)

PLANER:

42"x42"x12' Woodward & Powell

MISC:

18" BG Cincinnati Plain milling machine (comparable to #1½)
#0 Brown & Sharpe Forming & Cutting off machine
Acme double spindle bolt threader
Putnam pipe reamer.

RECONSTRUCTION MACHINE TOOL CORP.
199 Centre St. New York, N. Y.

We offer—AVAILABLE FOR PROMPT DELIVERY

(Subject to prior sale)

CRANES, Locomotive

15-ton Brownhoist, 50' boom
20-ton Industrial, 50' boom
22-ton O. & S., 50' boom

CRANES, Gantry

McMyler Portal Pier, electric.
Brownhoist Portal Pier, elec.

CRANES, Crawler

2-yd. Ind. Brownhoist "BC" Steam—new in 1936

10-ton Bay City, 40' boom, GAS Model 105 Northwest Comb. Crane Shovel & Dragline, rebuilt

CRANES, Overhead

25-ton Bedford, 2 motor, 50' span AC
10-ton Shaw, 3 motor, 48' span, D.C.
10-ton Northern, 3 motor, 51' span AC

★★★ Advise us of your crane need!

STEEL BUILDINGS

45'x170' with 7½ ton AC O.H. Crane
51'x245' with leantos & 2 O.H. Cranes 7½ & 5 ton, 50' span
50'x100' with extra 100' outdoor runway & 10-ton OH Crane
50'x700' with leantos, prov. for craneway
250'x325' divided into 3 aisles and one aisle provided with craneway

OUTDOOR CRANE RUNWAY

780' long—28' high

A. C. MOTORS

30 Units, 15 to 75 H.P., squirrel cage, 3/60/440

D. C. MOTORS

15 Units, 3 H.P. to 50 H.P. 230 V.
40 KW, 110 V. D.C. Generator
200 KW, 600 V. Motor Gen. Set, sync. motor, 3/60/2200
500 KW, G.E. Skinner Uniflow Steam Engine Gen. 250 V. D.C.
500 KW, Westg. 3/60/4100, direct conn. to 250 V. Generator
1000 KW, Turbine Type G.E. Generator, 3/60/2300, 3600 RPM

ALSO OTHER MOTORS. Write for our complete Motor Lists!!!

MISCELLANEOUS

No. 8 Ajax Bulldozer, motor drive

PIPE THREADING MACHINES

1 Landis, 1" to 4"
1 4-B Williams, high production
1 2" Bignall & Keller
WHEEL LATHE, Niles, center drive for truing car wheels, M.D.
Sandslinger, Beardsley & Piper "S"
SHOVEL, 6½-yd. Bucyrus, 320-B Electric Stripping
SHEARS, #3 Ryerson Lennox Bevel, 1# cap. #7 Lever (Alligator Type) cap. 6½" sq. or 4" x 24" soft cold steel
STEEL STORAGE TANKS—expertly rebuilt!

YOUR Direct or Indirect INQUIRIES and OFFERINGS For/In our "Line"

***Anything* containing IRON or STEEL**

IRON & STEEL PRODUCTS, INC.
13498 S. Brainard Ave. Chicago, Illinois

37 YEARS' EXPERIENCE

***"Anything* containing IRON or STEEL"**

REYNOLDS
MACHINERY CO.

1—6 Spindle Leland Gifford Drill
1—6 Spindle Allen Drill
1—34" Cincinnati Upright Drill, S.P.D.
1—400 lb. M & G Automatic Drop Hammer
1—Gleason Spur Gear Testing Machine, MD
1—#4-48" B & S Automatic Gear Cutter
1—Oliver Drill Thinner MD
1—#16 B & S 10" x 72" Cylindrical Grinder
1—72" Springfield Knife Grinder
4—#55 Cochrane-Bly Cold cut off Saws
1—Laidlow Metal Cutting Band Saw MD
1—Avery "Millband" 6" Hack Saw Machine MD
1—#2A Gale & Sawyer Thread Miller
1—#10-C Quick Work Rotary Shear, 14 gage 48" throat

WE BUY ENTIRE PLANTS

GA spee 5187

171 PINE ST. PROVIDENCE, R. I.

Immediate Delivery

42"x42"x14' Pond Planer, 2 Hds. on cross rail.
No. 12 Barber-Colman Gear Hobbers, S.P.D. (3).
24" Gisholt Automatic Lathe, S.P.D.
2" Cleve. Model B Automatic, 18" Fd.
No. 42 Van Norman Oscillating Grinder, M.D.
No. 13 Pratt & Whitney Profiler, Arr. for M.D.
6 ft. Pond Radial Drill, Cone Drive.
Aetna Swager, 4" Capacity.
No. 1 Southwark Nibbler, ¼" Capacity, 18" Throat.
Hutto Honing Machine, 8" Stroke.
No. 5 Bliss Stiles Type Punch Press, B.G.
20 Ton Fox Straightening Press.
No. 3D Gardner Polishing Lathes, M.D. (2).
No. 3 Gardner Polishing Lathes, T&L pulleys, (50).
100 KW Federal Projection Welder, 220 V.
Pangborn Rotary Table Sand Blast, 8½' Tble.
76"x40" Sly Tumbling Mill.

Many More—Send Us Your Inquiries

Surplus Material & Machinery Co.
8735 KERCHEVAL AVE. DETROIT, MICH.

8" WILLIAMS PIPE MACHINE
S.P.D. Complete
2" LANDIS P. PIPE MACHINE
motor driven. Complete

ADVANCE MACHINERY EXCHANGE, Inc.
182 Centre Street • New York City

IMMEDIATE DELIVERY

4" GRIDLEY MODEL H 4 SPINDLE AUTOMATIC CHUCKING MACHINE; WITH AIR CHUCKS; A.C. MOTOR DRIVEN. NEW IN 1928. REBUILT.

BARRON MACHINERY COMPANY
627 W. Washington Street, Chicago, Illinois

500# B & S Board Drop Hammer.
800# B & S Board Drop Hammer.
#14 Cochrane-Bly Vert. Miller & Shaper, M.D.
36" G & E Gear Cutter.
4' Bickford Radial Drill.
#55 Heald Internal Grinder.
10' Bridgeport Knife Grinder.
20"-24" G & E Shapers
36" Morton Draw Cut Shaper.
No. 2 Baker Keyseater, 2"x20".

WEST PENN MACHINERY COMPANY
1210 House Bldg. Pittsburgh, Pa.

ROLL LATHES

54"x20' Standard Compound Geared Head for direct motor drive with plano and necking rests. Limited service—Excellent condition.
42"x20' United Open Head, cone drive, with plano and necking rests. Good.

PLANERS

36"x36"x12' Flather, 2-Heads on rail, power elevation, motor mounted on housing, 10 HP, 3/60/220 volts. Est. Wt. 12,000 lbs. Very good condition.
30"x30"x10' Cleveland Openside, 1-rail, 1-side head, table 27⅝" wide x 10' betw. pockets, self-contained belt drive. Wt. 17,000 lbs.

(All for immediate delivery)

GALBREATH MACHINERY COMPANY
306 Empire Bldg. Pittsburgh, Pa.

FOR SALE—WELDERS

Due to change in Government Specifications, we have for immediate sale the following practically new equipment: Taylor-Winfield DP-12-250 KVA 12" throat, direct operated press welder. G. E. Non-beat pulsation type sequence timer including 24 volt control. G. E. full electronic control. These machines run on 220 volt, single phase, 60 cycle power service.

The Cincinnati Ball Crank Co.
Disney St. near Marburg—Cincinnati, Ohio

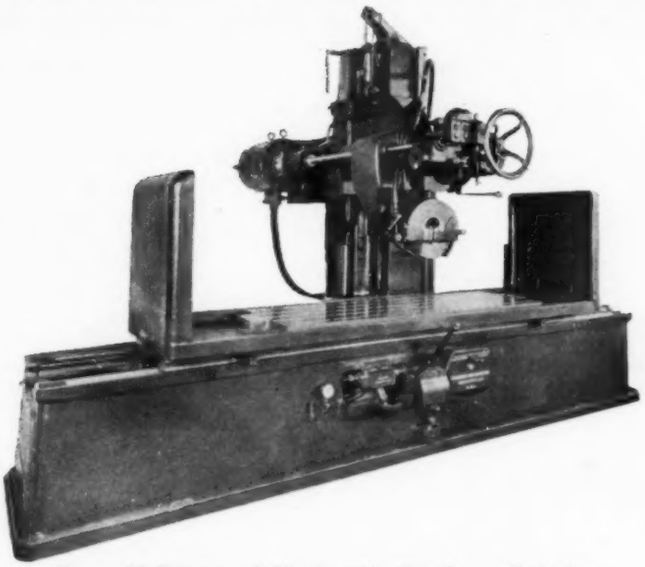
NEW "SEARCHLIGHT" ADVERTISEMENTS

received by October 6th, will appear in the October 15th issue, subject to limitations of space available.

Address copy to the Departmental Staff

AMERICAN MACHINIST
330 West 42d St., New York City

DIAMOND HYDRAULIC GRINDER



Type H Diamond Hydraulic Surface Grinder

Table 20" x 72" working surface.
Capacity 12" high x 16" wide x 72" long.
Table speed 5 to 65 ft. per minute—hydraulic controlled.
Rapid traverse cross and vertical feeds.
With 18" x 72" magnetic chuck.
Complete with motors and electrical equipment.
Weight about 10,700 lbs.

IMMEDIATE DELIVERY

LOUIS E. EMERMAN & CO.

Chicago, Illinois

MORRIS MACHINERY CO.

INC.

NEW AND USED MACHINE TOOLS AND FACTORY EQUIPMENT

Your Inquiries Are Appreciated

93-115 Chestnut Street **Newark, N. J.**

Phones: Mitchell 2-1122-3-4

COME HERE FOR WHAT YOU NEED

MODERN METAL WORKING EQUIPMENT

Perfectly reconditioned by BUFFALO
Let us have your requirements

BUFFALO MACHINERY COMPANY, INC.

837 GRANT ST. **BUFFALO, N. Y.**

MODERN TOOLS

Immediate Delivery

LATHES
Lodge & Shipley 16" x 8' Q. C. M. D.
Davis 16" x 8' Q. C. M. D.
LeBlond 21" x 10' G. H. Crankshaft
Lodge & Davis 16" x 6'
Bullard M. D.
Prentice 22" x 12'

TURRET LATHES
Woods Tilted Turret 1⅝"
Woods 1"
Acme 1½"
Millholland 1⅝"
Gisholt 24"—2" thru Spindle
Gisholt 5¾" thru Spindle

GEAR CUTTERS
26" Brown & Sharpe
36" Fellows
G. E. 3x36 Spur

AUTOMATICS
2—Gridleys 4 Spindle ⅞" Capacity
1—National Acme, M. D. #55
2—New Britains 4 Spindle 1" x 5"
Cleveland 4 Spindle ⅞" Capacity M. D.

MILLERS
#C Becker Miller, Vertical
#1½ American Horizontal
#3 Les Bredner Thread Miller

GRINDERS
Modern 16" x 60" M. D. Blocks up to 22"
Pratt & Whitney 12" x 24 M. D.
2—12" x 24" Cincinnati Universal Grinders
1—10" x 24" Landis, M.D.

SHAPERS
14" Chase
16" Barker
16" Ohio
24"G. E. M. D.

RADIAL DRILLS
6' Prentice Geared Box M. D.
4' Niles, M. D.
4' Bickford
24" Snyder Sliding Head Drill Press
2—Foote Burt Heavy Duty Drills

BORING MILLS—VERTICAL
40" Bickford Boring Mill—Single Turret, head on rail.
36" Car Wheel Boring Mill

BORING MILLS—HORIZONTAL
4" Single Pulley Driven Bickford
2" Binsee

MISCELLANEOUS
40" x 40" x 12' New Haven Planer, 2 heads on rail with 1 side head.
36" Throat Heavy Duty Punch, M. D.
1000 lb. Chambersburg Steam or Air Hammer, Single frame.
10" & 12" Slotters—Newton
25 Ton Bedford Crane—50' Span
16" Beasley Ball Bearing Grinder
3—Form Rolling Machines (5 sets of Form Rollers)

This is only a partial list

What do you need?

Contact us for rebuilt machinery

S. & S. MACHINERY CO.

207 CENTRE STREET
NEW YORK, N. Y.
WOrth 4-5710

CONSISTENT!

One idea dominates all of our work—
"To win the War Quickly."

To accomplish this end we have gradually expanded our rebuilding facilities and personnel, being careful at all times, to maintain a constant check on the "quality" of our output. We are now delivering more rebuilt Machine Tools than ever before. We have a bigger back log of orders to be filled than ever before in our history.

And now—as heretofore—we are striving to our utmost to maintain or enhance our good name.

MDNA MEMBER

LAKE MACHINERY CO.

654 West Lake Street **CHICAGO, ILLINOIS**

HIGH GRADE MACHINE TOOLS

LATHES

16" x 10' South Bend Gap Type Lathe. Standard Change.
42" x 14' Niles Lathe, Cone Drive.

GRINDERS

#60 Heald Internal, Belt Drive
#14—20" Besley Disc Grinder, Belt Drive.
16" x 72" Landis Self Contained Plain Grinder, M.D. Complete.
#5 Oliver Drill Grinding Machine, M.D.
#50 Heald Internal Cylinder Grinding Machine.

GEAR CUTTERS

#3—26" B & S Automatic Gear Cutter.
#1 Adams Gear Hobber, Belt Drive.
#00 Pfauter Gear Hobbing Machine, M.D.
#1 Schuchardt & Schutte Gear Hobbing Machines.
#18H Gould & Eberhardt Gear Hobbing Machine.
#5-60" B & S Automatic Gear Cutting Machine.
Bilgram Automatic Gear Cutter.

BOLT & PIPE THREADERS

4" Williams Pipe Machine.

SHAPERS & PLANERS

16" Rockford Crank Shaper, Back Geared.
32" x 32" x 18' Gray Planer, 2 Heads.
60" x 48" x 18' Betts Planer, side Head and rail head.

MILLERS

48" x 35" x 8' Niles Bement Pond Planer Type Slab Miller, Adjustable rail, Two vertical Heads, Horiz. rail, M.D.

CINCINNATI MACHINERY & SUPPLY CO.
217 East Second St. Cincinnati, Ohio

---

96 INCH GLEASON COMBINATION BEVEL AND SPUR GEAR PLANER

CAPACITY: Bevel or Spur gears to 96" Dia. x 24" Face, unlimited pitch.
Motor Driven with 220 Volt DC 1000 to 1800 R.P.M. Motor
With large assortment of cutters.

INDIANAPOLIS MACHINERY & SUPPLY CO., INC.
1959-69 South Meridian Street
Indianapolis, Ind.

BEDFORD 42" x 42" x 14' OPEN SIDE PLANER

1 cross head, 1 side head.

AARON MACHINERY CO.
45 CROSBY STREET NEW YORK, N.Y.

"INTERSTATE HAS IT"

SNYDER 2 WAY HORIZONTAL BORING REAMING & DRILLING MACHINE: M.D. FOOT BURT 2 SPINDLE VERT. DRILL.

RADIAL DRILLS
4' HAMMOND; 10' P&H Wall type; 6' WESTERN.

GEAR MACHINERY
NO. 6A CINCINNATI, 72" spur gear.
G & E BEVEL GEAR ROUGHER: 4 stations.
NO. 12 BARBER COLEMAN GEAR HOBBERS.

LATHES—FLOOR
30' PIT, 156" face plate, Face plate drive.
52"x22' FIFIELD; 24"x15' NEW HAVEN, B.G.
26x46"x20' SCHUMACHER & BOYE.
20"x10' AMERICAN, Grd. Hd.
18"x10' BRADFORD; 16"x8' BRADFORD.
26"x18' DRAPER; 14"x6' HENDEY, QCG.
NO. 16 GISHOLT SIMPLIMATIC PRODUCTION LATHE, 23" swing.

PLANERS
36"x36"x10' NILES; 30"x30"x10' DUSTIN.
22"x20"x5' POND; 28"x8' ROCKFORD; M.D.

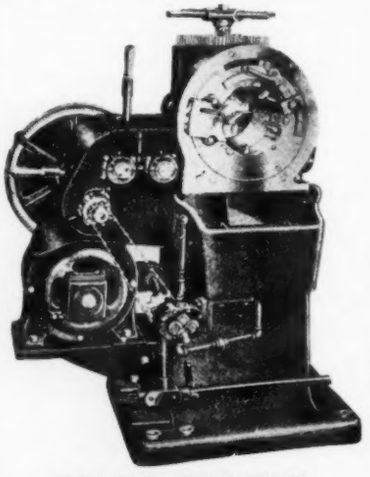
WIRE MACHINES
NO. 3 NILSON. 3/16" cap., M.D.

SPOT WELDERS
AEF: 15 KVA, 13 KVA, 9 KVA, 16", 18" throats.
27 & 20 KVA TAYLOR WINFIELDS.
17 KVA THOMSON; 40 & 50 KVA DYERS.
20 KVA WINFIELD, 24" throat. 20 KW ACE.
SEAM: 25 KVA THOMSON, 22" THROAT.

LARGE PRESSES
CLEARING CRANKLESS TRIPLE ACTION
4 point suspension type; Bed 84"x133"; M.D.; All steel construction; Self-contained gears enclosed running in oil.
NO. 178 TOLEDO TOGGLE DRAWING; 440 tons; Tie rod; Plunger slide str. 10"; Blankholder str. 18"; 51" bet.; M.D.
NO. 8-E BLISS DOUBLE CRANK; Tie rod; air cushions; 8" str. 8" shaft, 108" bet.
NO. 205-E TOLEDO GAP FRAME D. C.; 5" str. B. G., Bed 26x72"; 60½" bet.
Large Stock add'l Presses, all sizes all types—Send for PRESS BULLETIN!

INTERSTATE *Machinery Co., Inc.* Tel. Yards 5800
1439 W. PERSHING RD., CHICAGO, ILL.

6" REBUILT Merrell motor driven Pipe Machine complete with oil pump, one set of right hand dies, 1" to 6", and 2 H.P. motor suitable to purchaser.



FRANK TOOMEY MACHINERY COMPANY
116 N. 3rd St. Phila., Pa.
Walnut 5575

For Early Delivery
Used

15' BETTS VERTICAL BORING MILL

10' Extended to 15'—2 Motor Drive.
2 Swivel Heads. 2 tables.

Inquire

HASCO MACHINERY CO.
NEWARK, N. J.

ST. LOUIS' Headquarters FOR GOOD USED TOOLS, OFFERS:

ROCKFORD 24" S.P.D. Shaper
COLBURN 42" Vert. Boring Mill
MUELLER 4½' Gear Box Drive Radial Drill
PUTNAM 27"x14' Q.C.G. Lathe
PRENTICE 24"x12' M.D. Grd. H.D. Lathe
KEMPSMITH #2 Univ. Miller
NILES 12" Vert. Slotter
INGERSOLL 2—SP. Vert. Miller
B&S 48"x10" #4 Gear Cutter
BROWN & SHARPE #2 Hd. Screw Mach.
GOULD & EBERHARDT Rotary Milling Mach.

Write Us For Any Other Tools You May Want
Let Us Quote On All Machinery Needs

McDONALD MACHINERY CO.
1531-35 N. Broadway St. Louis, Mo.

OTT MACHINERY SPECIALS

AUTOMATICS

Brown & S. #00 and #1 Cut-off
Cleveland, Model A 1 1/16", Magazine
Model B ⅞", 1 1/16", 1½" and 2½"
Model G ⅞", 5-Hole Turret
Gridley 9/16" Model G 4-spindle, M.D.
Gridley 2¼" & 4¼" Single Spindle
New Britain, #22 and #24 Chuckers
Potter & Johnston #5-A

BROACHES

#3 LaPointe Single, Screw Type, M. D.
#V-18 American Vertical, 6-Ton Capacity

DRILLS

Heavy Duty, Barnes 20" Camelback
Minster #9, #4 Morse Taper
Moline 6-Spindle #17-D Hole Hog
High Speed Ball Bearing, 1 to 4 Spdl.
Horizontal, Detroit 5-spindle Semi-Auto.
Radial, 3' Bickford and 3¼' Fosdick
Sliding Head, 26" Mechanics #4 Morse T.
36" Superior, #5 Morse Taper

GEAR MACHINERY

Barber Colman #3 and #12 Hobbers
Brown & Sharpe, #3-36" Cutter
Fellows 36" Gear Shapers
Lees Bradner #5A Gear Hobbers
Barber Colman #3 Hob Grinder
Cross #1 Gear Tooth Rounder

GRINDERS

Cylinder, #65 Heald, Belt Drive
Disc, #14 Besley, 26" dia. disc
Internal, #5 Bryant, Motor Drive
#6, 15A, and 18 Bryant Internals
Plain, 10" x 36" Landis Type B, M.D.
10" x 36" Landis Type D.C., Hydraulic table traverse, Hydraulic Cross Feed, M.D., Late Type Machine
10" x 36" Norton Countershaft
14" x 30"-36" Norton Type B-81, M. D.
14" x 36" Norton, Motor Drive
Spline, Universal, Excello M.D. Spdl.

LATHES

14" x 6' American Q.C.G., M. D.
16" x 6' Lodge & Shipley, Q.C.G., M.D.
16" x 8' Lodge & Shipley, Q.C.G., M.D.
20" x 10' Canadian, Q.C.G., M. D.
60"/85" x 17' Putnam, L. C. G.
LeBlond Production, 17" x 5', Hex Turret
Springfield Fox Type Turret

MILLING MACHINES

Automatic, 18" Cincinnati
Duplex, #8 Becker and #2½ P&W
Production, Type A Briggs, B/D
#32 Kempsmith, B/D
Rotary Drum Type, #1, 2, & 3 Craftsman
Spline, 3" and 4" Pratt & Whitney
Vertical, #2 Becker with Rotary Table
42" Ingersoll Rotary, 2 Spdl., M. D.

PLANERS

30" x 30" x 8' Whitcomb Double Housing
36" x 36" x 13' Patch, Openside
39" x 39" x 13' Bedford Openside, M. D.

PRESSES

Double Crank, #77-B Niagara, 36" BU
Deep Throat, #78½ Bliss, M. D.
Horning, #25 Cleveland & #41 Toledo
O.B.I., #2½ Bliss Consolidated
#2 Federal, M.D. and Dial Feed
#40 Perkins, 3" Crank, B/D
S.S.S.C., #64 Consolidated, B/D
Solid Back, Bliss, Ferracute & Toledo

MISCELLANEOUS

Furnace, American Rotary Gas
Hone, Model MCAX Hutto 2-Spindle, M.D.
Lappers, Bethel Player, M. D.
Nibblers, #102 Gray and #1 Campbell
Profilers, 2 spindle Reed Prentice, Garvin and Pratt and Whitney
Riveters, #5A and 5½B High Speed Hammers
#6 Whiting Stake Riveter
Shapers, 16" Milwaukee, M. D.
28" Smith & Mills, Planer Type
Shear, #411-E Toledo, 5' x 11 Gauge
Tappers, #1, 2, and 2X Garvin
#3 Holmes 6-Spindle Tilted
Webster & Perks 5-spindle Nut Tapper

OTT MACHINERY SALES, INC.

542 Second Avenue — Detroit, Mich.

UNUSUAL VALUES

12"x6' Seneca Falls lathe, loose change gear
3½" x 50" Fitchburg Lo-swing Lathe.
1 Lodge & Davis turret with cross slide turret
Brake: Robinson toggle 5'
#2 Kempsmith Universal Milling Attachment (new)
Drill Presses: 28", 24" Hoefer; 25", 20", 40" Bement
Ceiling Suspended Drill Unlimited drilling area
Grinders: #20 Bryant Internal
Sellers Tool Grinder
300 other machinery items
Rock River ⅞" capacity punch and shear
1—3-spindle 1" capacity Bolt Cutter.
1—2-spindle #0 Webster & Perks Threading Machine. 14" Niles Traveling Head Shaper, two tables.
2—¾" capacity Punch and Shears.
MOTORS—new 5 H.P. for 3-phase, ball brg.

Also rebuilt motors.

THE OSBORNE & SAXTON MACHINERY CO.
COLUMBUS, OHIO

1—No. 3 Cincinnati Vertical Mill, M.D.
1—No. 13 Natco Multiple Drill, M.D.
1—No. 13B Brown & Sharpe Plain Mill, M.D.
1—No. 3 Ingersoll Combined Horizontal & Vertical Mill, M.D.
1—No. 1 Garvin Tapper
1—Dings Magnetic Separator
1—No. 2 Hannifin Air Arbor Press
1—No. 2 Baxendale Punch Press, M.D.
1—No. 62 Bliss Punch Press, M.D.
1—No. 1A Wm. Sellers Tool Grinder
1—No. 3 Holmes Tilted Tapper
1—Universal Gear Tester

YOUR INQUIRIES RECEIVE PROMPT ATTENTION

CENTRAL MACHINE TOOL CORPORATION

122-126 Nebraska Ave. — Toledo, Ohio

CYLINDRICAL GRINDER

13" x 96" LANDIS Plain Cylindrical Grinder Belt Drive machine, with countershaft; also headstock and tailstock.
Automatic Feed machine, including wheel-feed adjusting device.

ALSO MANY OTHER TOOLS

ALEX ZEEVE & COMPANY

2269 Woolworth Bldg — New York, N. Y.

AUTOMATICS, 6" x 6¾" Goss & De Leeuw. #34 New Britain Chucker

GRINDERS, #2 Churchill Internal, can grind 30" deep, dist. center of spin. to top of table 18"; 30" x 340" Landis Cyl.; 24" x 96" Landis Cyl.; 20" x 96" Landis Cyl.; 12" x 72" Landis; 12" x 96" Landis; 12" x 120" Landis; 14" x 96" Cincinnati; No. 25 A Heald 30" rotary.

GEAR CUTTERS—11" & 6" Gleason Bevel Gear Generators (4); 36" G & E Spur and Bevel. 48" & 36" Cinci spur (2). 60" Gould & Eberhardt, spur.

KEYSEATERS—#3 Baker, 26" stroke x 2" wide; #6 Catlin 40" stroke x 5" wide; #4 Mitts & M.

MILLING MACHINES—#3 Lees Bradner Thread Miller; #3 P & W die sinker; #6 Jackson Die Sinker or Vertical Miller; #2 P. & W. Jig Borer; No. 10 NBP vert. 60" diam. table.

PLANERS—72" x 72" x 16' Cincinnati, 2 heads. 1—60" x 60" x 16' Pond, 4 heads, D.C. reversing motor drive. 60"x48"x14' Bertram Openside 2 hds., DC Reversing M.D. 36"x36"x10' Flather. 2 hds. M.D. 26"x8' Gray, 1 head.

RADIAL DRILLS—7-ft. Amer. univ.; 5-ft. Cinci, Bickford, univ.; 5-ft. NBP univ.; 5-ft. NBP plain; 4-ft. Amer. plain, trip. purpose.

ROSENKRANZ MACHINERY CO.

30 Church Street — New York, N. Y.

LATHES
No. 324 Adriance Spinning

MILLING MACHINES
2" Pratt & Whitney spline (duplex) (Double)
No. 1 Foote-Burt Surface Broach
New No. 3 Wigglesworth
No. 2 Knight Vertical
No. 30 Sunstrand Rigid Mill M.D.

TURRET LATHES
Goss & De Leeuw Chucking, 6"x6½".

DRILLS
No. B16 Natco M.D. (2).
No. B13, Natco, M.D.
4 Spindle Taylor & Fenny M.D.

GEAR MACHINERY
6 Cimatool chamfering M.D.
No. 4—48" Brown & Sharpe Gear Cutter
Lees Bradner Gear Grinders (2)
9" Pratt & Whitney Gear Grinder

GRINDERS
No. 10 Brown & Sharpe Pl. M.D.
No. 11 Brown & Sharpe Pl. M.D.

MISCELLANEOUS
8" Bullard Multimattic M.D.
No. 1 Foote-Burt Duplex Surface Broach
8" Weiland Standard Pipe Machine
21'x21"x5' Whitcomb Planer
24x24x8 Whitcomb Planer
No. 303 Bliss St. Side Gd. M.D.
2" Acme Bolt Threader

WIGGLESWORTH MACHINERY CO.

203 Bent St., Cambridge, Mass.

• MODERN UPSETTERS •

5" AJAX, Twin Geared; Heavy Duty; M.D.
4" AJAX, Twin Geared; Heavy Duty; M.D.
3" AJAX, Twin Geared; Heavy Duty; M.D.

Must Be Moved at Once
—PRICED RIGHT—
INSPECTION UNDER POWER

INTERSTATE MACHINERY CO., INC.

1439 W. PERSHING RD., Chicago, Ill.

24" x 24" x 6' Wilson Planer, one head
No. 2 Pratt & Whitney Shaving Machine
No. 6 Fellows Gear Shaper
No. 1 Bilton Gear Milling Machine

D. E. DONY MACHINERY CO.

New and Used Machine Tools
47 Laurelton Road — Rochester, N. Y.

BROACH, No. 2 LaPointe, M.D.
GEAR CUTTERS, Spur, 30", 36" & 40", M.D.
GEAR PLANERS, Bevel, 36" & 54" Gleason, M.D.
GRINDER, Univ., No. 5 B & 8, 20" x 72".
GRINDER, 18' x 30' x 96' Norton Cyl., M.D.
LATHE, Driving Wheel, 78" Bement, Dbl. End.
PRESS, Hydr., 1000 ton Wood, platen 42" x 9'
SLOTTER 15" Dill Table Dia. 84".

LANG MACHINERY COMPANY

28th St. & A.V.R.R. — Pittsburgh, Pa.

IF YOU ARE DOING DEFENSE WORK

Send for Our Latest Circular Covering Bargains in Small Tools Such as Drills, Reamers, Turret Attachments, etc.

DeWITT TOOL COMPANY

173 Grand St. — New York City

WE BUY — WE SELL

No. 000 to No. 8—All types

REEVES DRIVES SPEED REDUCERS

All Ratios Up to 500 Horsepower

ALL DRIVES OVERHAULED

Money Back Guarantee

PATRON TRANSMISSION CO.

158 Grand St. — New York City

The SEARCHLIGHT SECTIONS (Classified Advertising) of McGraw-Hill Publications

can help you by bringing business needs or "opportunities" to the attention of other men associated in executive management, sales and responsible technical, engineering and operating capacities with the industries served by:

American Machinist
Aviation
Bus Transportation
Business Week
Chemical and Metallurgical Engineering
Coal Age
Construction Methods
Electrical Contracting
Electrical Merchandising
Electrical World
Electronics
Engineering and Mining Journal
Engineering News-Record
E. & M. J. Markets
Factory Management and Maintenance
Food Industries
Power
Product Engineering
Textile World
Transit Journal

"SEARCHLIGHT" Can Help You!

HUNDREDS of miscellaneous business problems that confront you from time to time, can be quickly and easily solved through the use of the Searchlight Section of this or other McGraw-Hill publications.

The Searchlight Section is the classified advertising appearing in each of these papers. You can use it at small cost, to announce all kinds of business wants of interest to other men in the fields served by these publications. It is the regular meeting place of the man with a miscellaneous business need and the men who can fill that need.

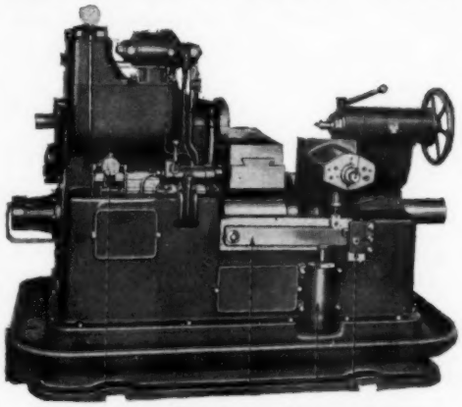
When you want additional employees, want to buy or sell surplus used or new equipment, want additional products to manufacture, seek additional capital, or have other miscellaneous business wants—advertise them in the Searchlight Section for quick, profitable results!

Departmental Staff

McGRAW-HILL PUBLICATIONS

330 West 42nd Street, New York City

VICTOR our Name — VICTORY our Business



2—#17 BARNES AUTOMATIC LATHES

Swing over front cross slide—13". Swing over rear cross slide—17". Swing over carriage bar—26". Distance center tailstock to center nose—20". 8 speeds, 30 to 375 R.P.M. Travel-front carriage standard—8". Rear carriage standard—6". Speed main drive shaft—600 R.P.M. Motor driven with 10 H.P., 3/60/440 Motor. Wt. approx. 6,500 lbs. Both machines fitted with quick action tail stocks.

AUTOMATICS
1¼" Cleveland Model A, M.D.
¾" Gridley, 4 spindle
4¾" Cleveland Model A

BORING MILLS
Boring Mill, 3" Binsee Horizontal
Boring Mill 3⅜" Dia. Rochester Floor Type

BROACHES
No. 1½ and No. 3 American Horizontal

DRILL PRESSES
No. 23 Foote Burt
No. 10 Defiance, 4 spindle tapping

GRINDERS
12x66 Landis Cylindrical
Ott 8"x16" Cylindrical
Grinder, 16"x48" Landis Crkshft. self-cont.
No. 72 Heald Internal M.D.

HOBBERS
Gear Hobbers, No. 12 Barber-Colman
Hobber 16 H.S. Gould & Eberhardt
No. 1 Lees-Bradner Production Hobber

LATHES
18x8 Mueller, Quick Change Gear Lathe, 21"x10 LeBlond q.c.g.
24"x14 Boye & Emmes, Q.C.G.
Lathe, 25x10 LeBlond Grd. Head
Lathe, 26"x16' Bridgeford q.c.g.
Lathe, 4AC LeBlond Crankshaft

MILLING MACHINES
Becker Lincoln Miller

PUNCH PRESSES
No. 908 Toledo Dble. Crank
No. 163½ Toledo Toggle
No. P-1—2—3—4 Ferracute (10)

SCREW MACHINES
No. 2 Pratt & Whitney

SHAPERS
16" Milwaukee B.G.
20" Ohio B.G.

SHEARS
Nos. 2 & 3 Doelger & Kirsten Alligator
14' Garrison ¼" cap. M.D.

MISCELLANEOUS
Davis & Thompson Piston Drilling Machs.
Worm Generator, 24" National Hyd. M.D.

MONA MEMBER

VICTOR Machinery Co.
135 S. Clinton St. ('Phone—CENtral: 3139) CHICAGO

AVAILABLE IMMEDIATELY!

N.B.P. 5' Radial Drill, Universal Arm, S.P.D.
Foote-Burt, 4 spindle Rail Drill, No. 4 M.T.
Bausch 8 spindle Drill 33" Round Head, 1⅜" capacity.
Bausch 12 spindle Drill 36" Round Head, 1¼" capacity.
Colburn 4 spindle Gang Drill, No. 3, M.T.
Fifield 72" x 46' bed Geared Head Engine Lathe, 15 speeds, triple gear, with chuck.
Becker No. 6 Vertical Milling Machine, motor driven.
Rock River No. 5 Bulldozer.
Williams No. 3 Pipe Machine, 1½" to 6" capacity.

MONA MEMBER

ACME EQUIPMENT CO.
128 S. Clinton Street CHICAGO, ILL.

½" & ⅞" Model A **Cleveland Automatic Screw Machines**
⅝" **National Acme** 4 Spindle Automatic
12" x 36' **Modern** Plain Cylindrical Grinder

MONA MEMBER

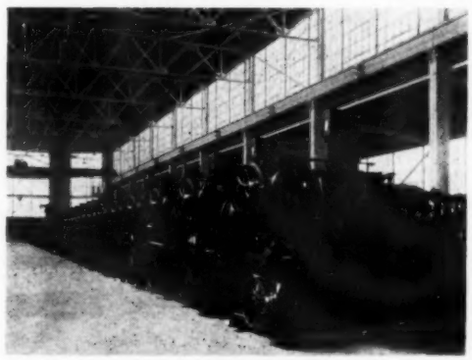
INLAND MACHINERY CO.
48 S. CLINTON ST. CHICAGO

IMMEDIATE DELIVERY!

25—1¼" GRIDLEY'S

MODEL F

4 spindle Automatic
SCREW MACHINES
All Motor Driven
In Excellent
Condition



(Actual Photograph)

READY FOR IMMEDIATE OPERATION!

MONA MEMBER

ADAMS MACHINERY CO.
114 SO. CLINTON ST. CHICAGO, ILL.

SNYDER TWIN RAM MASTER HYD. M. D. BORING & DRILLING MACH.
NO. 1 MICROHONER, MAX. CAP. 7.500" LONG x .875 DIA. M. D.
NO. 3 BRYANT H. D. SEMI AUTO. HOLE GRINDER. M. D.
NO. 3-26" B&S AUTO. GEAR CUTTER.
NO. 3 ADAMS FARWELL GEAR HOBBER.
NO. 73½ BLISS S. S. PRESS, FLYWHEEL.
NO. 21 BLISS KNUCKLE JT. EMB. & CNG. PRESS. GRD.
120 TON, NO. 6 WAT. FAR. TOGGLE PILLAR PRESS. GRD.
NO. 50 WAT. FAR. O. B. I. FLYWHEEL (4).
REED PRENTICE TWO SPINDLE PROFILER.
P&W AUTO. CAM CUTTER AND PROFILER.
NO. 5 HENDEY LINCOLN TYPE MFG. MILLS (2).
¾" GRIDLEY MODEL F, 4 SPDLE. AUTO.
12" CINN. MFG. MILLER.

MONA MEMBER

GEORGE M. BERNSTEIN & CO.
18 S. CLINTON ST. CHICAGO, ILL.

Partial List—Send us your Inquiries

Boring Mill: 4" Bar, **Niles**, Knee type.
Broach: V-18 **American**, Vertical.
Gear Generators: 6", 11", & 18" **Gleason.**
Grinders: 16" x 60" **Landis** Crankshaft. 53" Gardner Horizontal Disc.
Miller: No. 4 **Hendey**, Lincoln type.
Screw Machines: ¾" & 1¼" Model F. **Gridley**, 4 Sp.

MONA MEMBER

SEGAL MACHINERY CO.
113 So. Clinton St. Chicago, Ill.

How to save time by doing more reading

That is a profitable paradox for you. More true today than perhaps ever before. For here in the pages of this publication are packed many helpful ideas . . . considerable useful information. Much of it, in fact, available from no other source.

And we most emphatically mean to include the advertising pages, as well as the editorial pages.

Just one new idea gleaned from these pages . . . a method for doing something better or faster or easier or at lower cost, may alone save you far more than a year's reading-hours invested in this and other worthwhile business papers.

Many people have found this a fact . . . not only once, but time and time again. That's significant . . . with time so precious today.

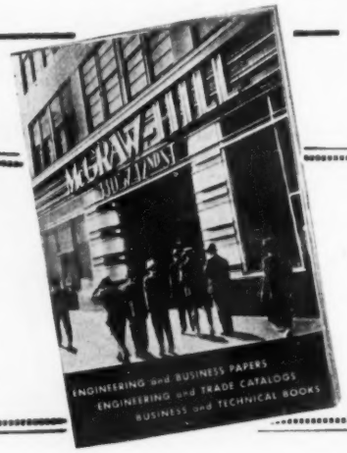
Good advertising speeds information from those who have it . . . to those who need it.

McGraw-Hill Publishing Company, Inc.

330 West 42nd Street New York

This Free Booklet May Help You Now

There are 23 McGraw-Hill Publications covering many branches of Business and Industry;—mining, metal-working, transportation, manufacturing, engineering design and heavy construction. Over a million readers are finding them constantly helpful in carrying out today's vital work in the army of production. Perhaps one of them would prove interesting and helpful to you. A 24-page illustrated booklet, describing each one in some detail, will be sent FREE, on request . . . this booklet has been prepared to help you select the paper which will serve you best. Just fill in and mail the coupon below.



McGRAW-HILL PUBLISHING CO., INC.
330 West 42nd St., New York, N. Y.

Gentlemen:
I would like to have your free booklet describing McGraw-Hill Publications.

Name .....

Company .....

Address .....

Our business is .....

WHERE-TO-BUY DIRECTORY

ABRASIVE GRAIN & STONES (See GRAINS, Abrasive)

ABRASIVE PAPERS & CLOTH (See PAPER & CLOTH, Abrasive)

ALLOYS, Aluminum (See ALUMINUM)

ALLOYS, Copper
American Brass Co., Waterbury, Conn.
Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., New Castle, Pa.
Revere Copper & Brass Inc., N. Y. C.

ALLOYS, Corrosion & Heat Resistant
Allegheny-Ludlum Steel Corp., Pittsburgh
Aluminum Co. of America, Pittsburgh
American Brass Co., Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Bunting Brass & Bronze Co., Toledo, O.
Carboloy Co., Detroit
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Dow Chemical Co., Midland, Mich.
Firth-Sterling Steel Co., McKeesport, Pa.
Haynes-Stellite Co., N. Y. C.
Latrobe Electric Steel Co., Latrobe, Pa.
Mallory & Co., Inc., P. R., Indianapolis
Republic Steel Corp., Cleveland
Revere Copper & Brass, Inc., N. Y. C.
Ryerson & Son, Inc., Jos. T., Chicago
Timken Steel & Tube Div., Canton, O.

ALLOYS, Magnesium
American Magnesium Co., Pittsburgh
Dow Chemical Co., Midland, Mich.

ALLOYS, Special Iron
American Brake Shoe & Fdry. Co., N. Y. C.
Meehanite Research Institute, Pittsburgh

ALLOYS, Steel
Allegheny-Ludlum Steel Corp., Pittsburgh
Bethlehem Steel Co., Bethlehem, Pa.
Boker & Co., Inc., H., N. Y. C.
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Climax Molybdenum Co., N. Y. C.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Disston & Sons, Inc., Henry, Philadelphia
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc. Div., Newcastle, Ind.
Jones & Laughlin Steel Corp., Pittsburgh
Latrobe Electric Steel Co., Latrobe, Pa.
Republic Steel Corp., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Timken Steel & Tube Div., Canton, O.
Union Drawn Steel Co., Massillon, O.
United States Steel Corp., Pittsburgh
Vanadium-Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy Co., Inc., Cambridge, Mass.
Wyckoff Drawn Steel Co., Pittsburgh

ALUMINUM
Aluminum Co. of America, Pittsburgh

ANODES & CATHODES
American Brass Co., Waterbury, Conn.
Revere Copper & Brass, Inc., N. Y. C.

ARBORS & MANDRELS
Atkins & Co., E. C., Indianapolis
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Detroit
Cincinnati Milling Mach. Co., Cincinnati
Cleveland Twist Drill Co., Cleveland
Cushman Chuck Co., Hartford, Conn.
Disston & Sons, Inc., Henry, Philadelphia
Firth-Sterling Steel Co., McKeesport, Pa.
Gisholt Machine Co., Madison, Wis.
Gleason Works, Rochester, N. Y.
Greenfield Tap & Die Corp., Greenfield, Mass.
Illinois Tool Works, Chicago
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee
Latrobe Electric Steel Co., Latrobe, Pa.
Lee & Son, K. O., Aberdeen, S. D.
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Tool Co., Cleveland, O.
National Twist Drill & Tool Co., Detroit
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Pratt & Whitney Div., Niles-Rement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth, Mich.
Warner & Swasey Co., Cleveland

ATTACHMENTS, Broaching Machine
Colonial Broach Co., Detroit

ATTACHMENTS, Grinding Machine
Abrasive Mach. Tool Co., E. Providence, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati
Covel Mfg. Co., Benton Harbor, Mich.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Landis Tool Co., Waynesboro, Pa.
Liberty Tool & Gage Wks., Providence, R. I.
Norton Co., Worcester, Mass.
Thompson Grinder Co., Springfield, O.

ATTACHMENTS, Lathe
American Tool Works Co., Cincinnati
Ames Co., B. C., Waltham, Mass
Atlas Press Co., Kalamazoo, Mich.
Auto Ordnance Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati
Cincinnati Lathe & Tool Co., Cincinnati
Dumore Co., Racine, Wis.
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Hendey Machine Co., Torrington, Conn.
Jefferson Mach. Tool Co., Cincinnati
LeBlond Mach. Tool Co., R. K., Cincinnati
McCrosky Tool Corp., Meadville, Pa.
Monarch Machine Tool Co., Sidney, O.
Pratt & Whitney Div., Niles-Bemont-Pond Co., Hartford, Conn.
Reed-Prentice Co., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Boston
Rockford Mach. Tool Co., Rockford, Ill.
South Bend Lathe Wks., So. Bend, Ind.
Strand Co., N. A., Chicago
Warner & Swasey Co., Cleveland

ATTACHMENTS, Milling
Atlas Press Co., Kalamazoo, Mich.
Auto Ordnance Corp., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Lathe & Tool Co., Cincinnati
Cincinnati Milling Mach. Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Experimental Tool & Die Co., Detroit
Fray Machine Tool Co., Glendale, Calif.
Jefferson Mach. Tool Co., Cincinnati
Lempco Products, Inc., Bedford, O.
Kearney & Trecker Corp., Milwaukee
Kempsmith Machine Co., Milwaukee
National Machine Tool Co., Cincinnati
Porter-Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Machine Tool Co., Springfield, Mass.

ATTACHMENTS, Planer
Cincinnati Planer Co., Cincinnati
Sellers & Co., Inc., Wm., Philadelphia

ATTACHMENTS, Screw-Machine
Brown & Sharpe Mfg. Co., Providence, R. I.
Empire Tool Co., Detroit
Meisel Press Mfg. Co., Boston

ATTACHMENTS, Tapping
Avey Drilling Mach. Co., Cincinnati
Barber-Colman Co., Rockford, Ill.
Errington Mech. Lab., Stapleton, N. Y.
Greenlee Bros. & Co., Rockford, Ill.
Haskins Co., R. G., Chicago
Kingsbury Mach. Tool Corp., Keene, N. H.
Moline Tool Co., Moline, Ill.
Murchey Machine & Tool Co., Detroit
National Auto. Tool Co., Richmond, Ind.

BABBITT (See METALS, Bearing)

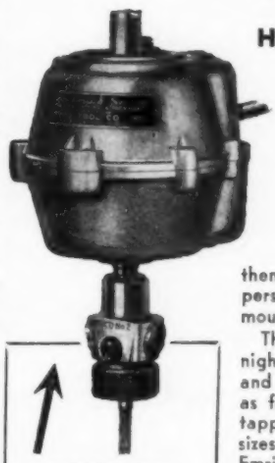
BALANCING MACHINES
Gisholt Machine Co., Madison, Wis.
Norton Co., Worcester, Mass.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

BALLS, Brass, Bronze & Steel
Ball & Roller Bearing Co., Danbury, Conn.
Federal Bearings Co., Poughkeepsie, N. Y.
SKF Industries, Inc., Philadelphia
Waterbury Steel Ball Co., Poughkeepsie, N. Y.

BARRELS, Tumbling & Burnishing
Waterbury Steel Ball Co., Poughkeepsie, N. Y.

BARS, Boring
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford, Ill.
Bullard Co., Bridgeport, Conn.
Carboloy Co., Detroit

END TAPPING BOTTLENECKS
with Ettco-Emrick
HIGH-SPEED, SENSITIVE
TAPPING ATTACHMENTS



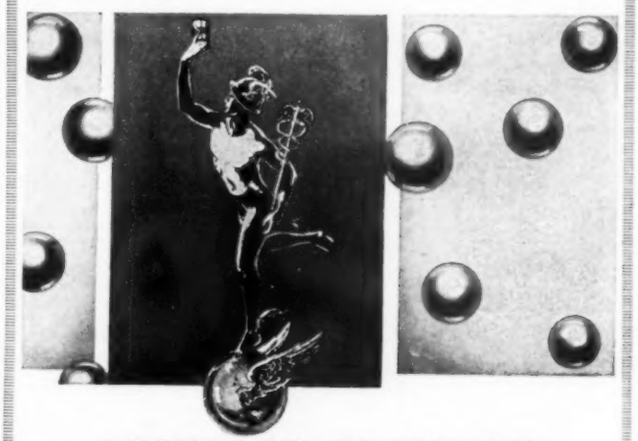
ETTCO-EMRICK TAP CHUCKS
Taps are sure to be properly inserted in these chucks because the grip is visible. 5 sizes for No. 0 to 1" taps. Details in Bulletin No. 6. Collet type chucks are available for No. 6 to ⅜" taps.

If your tapping machine capacity is not adequate to your tapping needs, put your drill presses to work. Ettco-Emrick Attachments clamped to their spindles will turn them into high-speed, sensitive tappers. **Quill Clamps** assure rigid mounting on any press.

These Attachments are not overnight developments, but time-tested and proved. With them you can tap as fast and accurately as machine tapping can be done. There are 7 sizes for No. 0 to 1" taps. Ettco-Emrick features of design and construction which make possible high-speed tapping with hair-trigger sensitivity are all covered in BULLETIN No. 2. Write for a copy today.

ETTCO TOOL CO., Inc.
590 Johnson Ave. Brooklyn, N. Y.
Detroit • Chicago

MAKERS OF *Ettco-Emrick* DRILL CHUCKS • TAP CHUCKS
MULTIPLE TAPPING AND DRILLING HEADS
TAPPING ATTACHMENTS • TAPPING MACHINES



ACCURACY—PRECISION
All WATERBURY STEEL BALLS are of uniform hardness which extends to the center of each ball. Made of high carbon chrome alloy steel highly finished.

WATERBURY STEEL BALLS
HIGH CARBON, CHROME ALLOY STEEL, BRONZE MONEL METAL, STAINLESS STEEL BALLS, STANDARD, OR SPECIAL SIZES. WRITE FOR COMPLETE INFORMATION.
THE WATERBURY STEEL BALL CO., INC.
Poughkeepsie, New York
Factory: Waterbury, Conn.

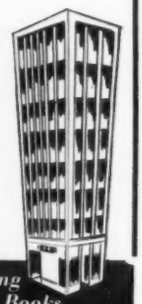
HOW TO TEACH SHOPWORK
In War Production Industries

★ *Teaches skilled men to teach green hands.*

Many plants must use skilled workers to train new men. Many of these experts have trouble passing on their "Know" because they have had no training in teaching, or organization of teaching materials.

"How to Teach Shopwork for War Production Industries" shows men how to teach others. How to break down the job into digestible pieces . . . how to organize and present it . . . how to apply the teaching in actual work . . . and how to check and test work of apprentice.

Written by P. T. McHenry. This material made ready for publication while author was in Instructional Materials Section, Vocation Training For War Workers, Washington, D. C.



Sent free to men responsible for employee training. No obligation. Make request on company letterhead.

McKNIGHT & McKNIGHT

BLOOMINGTON
ILLINOIS

One of America's Leading Publishers of Technical Books

ACCURACY

ATOMETRIC GAGE BLOCKS

PERFECTION IN MEASUREMENT
MEANS
PERFECTION IN YOUR PRODUCT

ATOMETRIC PRECISION GAGE LABORATORIES, Inc.
STAMFORD, CONNECTICUT, U. S. A.

LUCAS "PRECISION"
Horizontal Boring, Drilling and Milling Machine
THE LUCAS MACHINE TOOL CO.

NOW AND ALWAYS OF

CLEVELAND
OHIO, U. S. A.

BAUMBACH

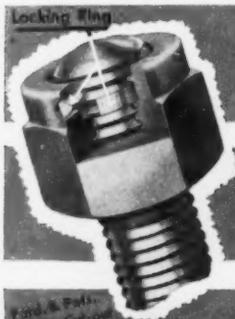
STANDARDIZED DIE SETS

BETTER-MADE
DIE SETS
AT LOWER COST

46 Styles—195,000 Sizes

E. A. BAUMBACH MFG. CO.
Machined Steel Drop Forged Steel Semi-Steel
Send for our new catalog
1812 South Kilbourn Ave., Chicago, Ill.

Locking Ring



UNSHAKO
Reg. U. S. Pat. Off.
SELF-LOCKING NUT
HOLDS TIGHT

Patd. & Pat'd. Pendg. Cut-out section showing locking ring in place.

STANDARD PRESSED STEEL CO.
BOX 4 JENKINTOWN, PENNA.

WHERE-TO-BUY DIRECTORY

Elmes Engrg. Wks., Chas. F., Chicago
Fray Machine Tool Co., Glendale, Cal.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Lucas Machine Tool Co., Cleveland
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Scully-Jones & Co., Chicago
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Boring Mach. Co., Hudson, Mass.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

BARS, Sine
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

BATHS, Heat Treating & Annealing
Houghton & Co., E. F., Philadelphia

BEARINGS & BUSHINGS
Aluminum Co. of America, Pittsburgh
Bunting Brass & Bronze Co., Toledo, O.
Carlyle Johnson Machine Co., Manchester, Conn.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Babbitt
Bunting Brass & Bronze Co., Toledo, O.

BEARINGS, Ball
Ball & Roller Bearing Co., Danbury, Conn.
Bantam Bearings Corp., So. Bend, Ind.
Bearings Co. of America, Lancaster, Pa.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearings Co., Poughkeepsie, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
S. K. F. Industries, Inc., Philadelphia
Schatz Mfg. Co., Poughkeepsie, N. Y.
Torrington Co., Torrington, Conn.

BEARINGS, Needle & Quill
Bantam Bearings Corp., So. Bend, Ind.
Federal Bearings Co., Poughkeepsie, N. Y.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Roller Bearing Co. of Amer., Trenton, N. J.
S. K. F. Industries, Inc., Philadelphia
Torrington Co., Torrington, Conn.

BEARINGS, Non-Metallic
Bakelite Corp., N. Y. C.

BEARINGS, Oilless & Graphite
Bunting Brass & Bronze Co., Toledo, O.
Carlyle Johnson Machine Co., Manchester, Conn.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Bantam Bearings Corp., So. Bend, Ind.
Fafnir Bearing Co., New Britain, Conn.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Roller Bearing Co. of Amer., Trenton, N. J.
S. K. F. Industries, Inc., Philadelphia
Timken Roller Bearing Co., Canton, O.

BEARINGS, Thrust
(See preceding classifications)

BELLOWS, Seamless Metal
Chicago Metal Hose Corp., Maywood, Ill.

BELTING, Leather
Greene, Tweed & Co., N. Y. C.
Houghton & Co., E. F. Philadelphia

BELTING, Rubber & Fabric
Dayton Rubber Mfg. Co., Dayton, O.
Gates Rubber Co., Denver, Col.

BELTS & BANDS, Abrasive
Behr-Manning Corp., Troy, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Dumore Co., Racine, Wis.
Mid-West Abrasive Co., Detroit
Norton Company, Worcester, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Walls Sales Corp., N. Y. C.

BELTS "V"
Allis-Chalmers Mfg. Co., Milwaukee
Dayton Rubber Mfg. Co., Dayton O.
Gates Rubber Co., Denver, Col.

BENCHES, Shop
Baumbach Mfg. Co., E. A., Chicago
Delta Mfg. Co., Milwaukee
Hardinge Brothers, Inc., Elmira, N. Y.
Hill Acme Co., Cleveland
New Britain-Gridley Machine Div., New Britain, Conn.
Rivett Lathe & Grinder, Inc., Boston
Standard Pressed Steel Co., Jenkintown, Pa.
Walker-Turner Co., Plainfield, N. J.

BENDERS, Hand
O'Neil-Irwin Mfg. Co., Minneapolis

BENDING & STRAIGHTENING Machines
Ajax Mfg. Co., Cleveland
Baldwin-Southwark Corp., Philadelphia
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati
Cleveland Punch & Shear Wks., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Elmes Engrg. Works, Chas. F., Chicago
Farrel-Birmingham Co., Ansonia, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ryerson & Son, Inc., Jos. T., Chicago
Schatz Mfg. Co., Poughkeepsie, N. Y.
Springfield Mach. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

BINS, Tool & Parts (See LOCKERS & SHELVING)

BITS, Tool
Allegheny-Ludlum Steel Corp., Pittsburgh
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carboloy Co., Detroit
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Colonial Broach Co., Detroit
Crafts Co., Inc., Arthur A. Boston
Disston & Sons, Inc., Henry, Philadelphia
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Latrobe Electric Steel Co., Latrobe, Pa.
McCrosky Tool Corp., Meadville, Pa.
McKenna Metals Co., Latrobe, Pa.
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Union Twist Drill Co., Athol, Mass.
Vanadium Alloys Steel Co., Pittsburgh
Vaseoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.
Williams & Co., J. H., Buffalo, N. Y.

BLADES, Circular-Saw (See SAW BLADES, Circular)

BLADES, Cutter, Milling, Boring & Reaming (See BITS, Tool)

BLADES, Hack- & Band-Saw
Armstrong-Blum Mfg. Co., Chicago
Atkins & Co., E. C. Indianapolis
Capewell Mfg. Co., Hartford, Conn.
Clemson Bros., Inc., Middletown, N. Y.
Continental Machines, Inc., Minneapolis
Disston & Sons, Inc., Henry, Philadelphia
Racine Tool & Mach. Co., Racine, Wis.
Starrett Co., L. S., Athol, Mass.
Thompson & Sons Co., Henry G., New Haven, Conn.
Victor Saw Works, Middletown, N. Y.

BLOCKS, Pillow
Allis-Chalmers Mfg. Co., Milwaukee
Earle Gear & Mach. Co., Philadelphia
Fafnir Bearing Co., New Britain, Conn.
Farrel-Birmingham Co., Ansonia, Conn.
Hill Acme Co., Cleveland
Norma-Hoffmann Bearnigs Corp., Stamford, Conn.
S. K. F. Industries, Inc., Philadelphia
Standard Pressed Steel Co., Jenkintown, Pa.

BLOCKS, Precision Gage
Atometric Precision Gage Laboratories, Inc., Stamford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., Dearborn, Mich.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Webber Gage Co., Cleveland

WHERE-TO-BUY DIRECTORY

BLOCKS, "V"
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

BLOWERS
Allis-Chalmers Mfg. Co., Milwaukee
American Gas Furn. Co., Elizabeth, N. J.
Buffalo Forge Co., Buffalo, N. Y.
General Electric Co., Schenectady, N. Y.
Strong, Carlisle & Hammond Co., Cleveland
Wagner Electric Corp., St. Louis

BLOWERS, Electric Hand
Buffalo Forge Co., Buffalo, N. Y.
Ideal Commutator Dresser Co., Chicago
Skilsaw, Inc., Chicago

BLUING, Layout
Dykem Co., St. Louis

BOLT & NUT MACHINES
Ajax Mfg. Co., Cleveland
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Consolidated Machine Tool Corp., Rochester, N. Y.
Eastern Machine Screw Corp., New Haven, Conn.
Federal Press Co., Elkhart, Ind.
Foote-Burt Co., Cleveland
Geometric Tool Co., New Haven, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haskins Co., R. G. Chicago
Hendey Machine Co., Torrington, Conn.
Hill Acme Co., Cleveland
Landis Machine Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
New Britain-Gridley Machine Div., New Britain, Conn.
Oster Mfg. Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Scherr Co., Geo., N. Y. C.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
V. & O. Press Co., Hudson, N. Y.

BOLTS, Eye & T-Slot
American Chain & Cable Co., Bridgeport, Conn.
Armstrong Bros. Tool Co., Chicago
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

BOLTS & NUTS
Bethlehem Steel Co., Bethlehem, Pa.
Elastic Stop Nut Corp., Union, N. J.
Parker-Kalon Corp., N. Y. C.
Republic Steel Corp., Cleveland
Standard Pressed Steel Co., Jenkintown, Pa.

BOOKS, Technical
McKnight & McKnight, Bloomington, Ind.

BORING, DRILLING & MILLING MACHINES, Horizontal
Atlantic Machinery Co., N. Y. C.
Avey Drilling Mach. Co., Cincinnati
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bryant Machinery & Engrg Co., Chicago
Buhr Mach. Tool Co., Ann Arbor, Mich.
Cincinnati Gilbert Mach. Tool Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Defiance Mach. Wks., Inc., Defiance, Ohio
Foote-Burt Co., Cleveland
General Machy. Corp., Hamilton, O.
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Greenlee Bros. & Co., Rockford, Ill.
Lucas Machine Tool Co., Cleveland
Moline Tool Co., Moline, Ill.
National Acme Co., Cleveland
National Auto Tool Co., Richmond, Ind.
Ohio Machine Tool Co., Kenton, O.
Sheffield Corp., Dayton, O.
Sellers & Co., Inc., Wm., Philadelphia
Snyder Tool & Engrg. Co., Detroit
Springfield Mach. Tool Co., Springfield, O.
Universal Boring Mach. Co., Hudson, Mass.
Yoder Co., Cleveland

BORING MACHINES, Jig (See JIG-BORING MACHINES)

BORING MACHINES, Precision
Barnes Co., W. F. & John, Rockford, Ill.
Bryant Machinery & Engrg. Co., Chicago
Ex-Cell-O Corp., Detroit
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Heald Machine Co., Worchester, Mass.
Leland-Gifford Co., Worcester, Mass.
Lucas Machine Tool Co., Cleveland
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Boston
Sheffield Corp., Dayton, O.
Universal Boring Mach. Co., Hudson, Mass.

BORING MILLS, Vertical
Baush Mach. Tool Co., Springfield, Mass.
Bullard Co., Bridgeport, Conn.
Cincinnati Planer-Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
King Machine Tool Co., Cincinnati
Sellers & Co., Inc., Wm. Philadelphia
Springfield Mach. Tool Co., Springfield, O.

BOXES, Tote
American Metal Works, Inc., Philadelphia, Pa.
Lucas & Son, Inc., J. L., Bridgeport, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

BRAKES, Bending, Power
Bryant Machinery & Engrg. Co., Chicago
Cincinnati Shaper Co., Cincinnati
Cleveland Crane & Engrg. Co., Wickliffe, O.
Cleveland Punch & Shear Wks. Co., Cleveland

BRAKES, Electric
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., E. Pittsburgh

BRICK, Furnace (See REFRACTORIES)

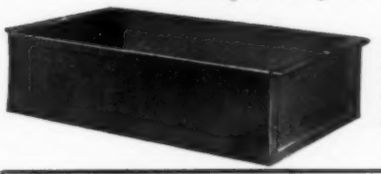
BROACHES
American Broach & Machine Co., Ann Arbor, Mich.
Butterfield & Co., Derby Line, Vt.
Colonial Broach Co., Detroit
Dalzen Tool & Mfg. Co., Detroit
Detroit Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
East Shore Mach. Pdts. Co., Cleveland
Ex-Cell-O Corp., Detroit
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Lapointe Mach. Tool Co., Hudson, Mass.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

BROACHING MACHINES
American Broach & Machine Co., Ann Arbor, Mich.
Cincinnati Milling Mach. Co., Cincinnati
Colonial Broach Co., Detroit
Consolidated Machine Tool Corp., Rochester, N. Y.
Elmes Engrg Works, Chas. F., Chicago
Foote-Burt Co., Cleveland
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lapointe Mach. Tool Co., Hudson, Mass.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
Thompson Grinder Co., Springfield, O.

BRONZE, Phosphor (See PHOSPHOR BRONZE)

BUFFERS & POLISHERS
Black & Decker Mfg. Co., Towson, Md.
Blount Co., J. G., Everett, Mass.
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Continental Machines, Inc., Minneapolis
Delta Mfg. Co., Milwaukee
Dumore Co., Racine, Wis.
Gardner Machine Co., Beloit, Wis.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Haskins Co., R. G., Chicago
Heald Machine Co., Worcester, Mass.
Hill-Acme Co., Cleveland
Jefferson Mach. Tool Co., Cincinnati
Landis Tool Co., Waynesboro, Pa.
Mattison Machine Works, Rockford, Ill.
New Britain-Gridley Mach. Co., New Britain, Conn.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Rotor Tool Co., Cleveland

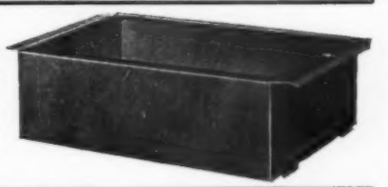
WAR PLANTS
STEEL BOXES FOR YOUR PRODUCTION NEEDS
Prompt Shipment



SHOP BOXES
A straight side shop box with rigid handle and hook hole each end. Excellent for shop use where stacking feature is not required.

No. 401 — 10"x16"x6" — 18 Gauge, each, $ .85
No. 402 — 12"x18"x8" — 16 Gauge, each, $1.10

STACKING BOXES
An ideal all-purpose shop box. Sturdy all-welded construction. Heavy skids act as a positive stacking lock and reinforce box at point of maximum wear.



No. 601 — 10"x16"x6" — 18 Gauge, each, $ .95
No. 602 — 12"x18"x8" — 16 Gauge, each, $1.25

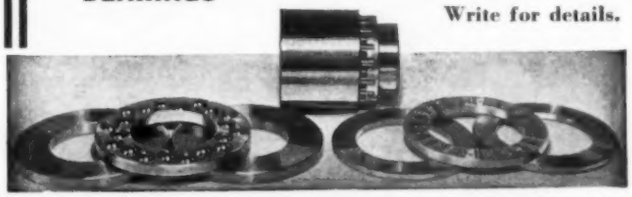
PRICES F. O. B. FACTORY, PHILADELPHIA
ANY QUANTITY
ORDER TODAY—WRITE, WIRE OR PHONE

AMERICAN METAL WORKS, Inc.
1523 Germantown Ave. Philadelphia, Pa.

B&RB....*Dependable!*
PRECISION BEARINGS

A complete line of standard sizes and types quickly available for accurate, dependable service in all sorts of applications.

Write for details.



THE BALL & ROLLER BEARING CO.
DANBURY, CONN.

METAL DUPLICATING *Without Dies*

DI-ACRO PRECISION MACHINES

Users of Di-Acro Precision Machines—Shears, Brakes, Benders—are constantly showing us new time-saving, cost-cutting applications, in experimental work, for making small quantities of parts—or even production runs. They often save expense and delay of making dies, or parts of progressive die sets. They do many things dies cannot do.

Photo (courtesy Minneapolis — Honeywell) shows Di-Acro Shear No. 1, which squares up stampings, cuts strips, makes slits or notches. All work accurate to .001."

Write for Catalog

O'NEIL-IRWIN MFG. CO.
311-8th Ave. S., Minneapolis, Minn.

WHERE-TO-BUY DIRECTORY

Schauer Machine Co., Cincinnati
Stow Mfg. Co., Binghamton, N. Y.
Strand & Co., N. A., Chicago
Union Twist Drill Co., Athol, Mass.
Vonnegut Moulder Corp., Indianapolis
Walker-Turner Co., Plainfield, N. J.

BUFFERS & POLISHERS, Hand
Behr-Manning Corp., Troy, N. Y.
Roberts Rubber Co., Weldon, Newark, N. J.

BULLDOZERS
Ajax Mfg. Co., Cleveland
Baldwin-Southwark Corp., Philadelphia
Beatty Mach. & Mfg. Co., Hammond, Ind.
Elmes Eng. Works, Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Watson-Stillman Co., Roselle, N. J.

BURNERS, Gas & Oil Furnace
American Gas Furn. Co., Elizabeth, N. J.
Hones, Inc., Charles A., Baldwin, N. Y.
Strong, Carlisle & Hammond Co., Cleveland
Surface Combustion Corp., Toledo, O.

BURNISHERS, Gear
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

BURNISHING MACHINES
Consolidated Machine Tool Corp., Rochester, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., Detroit
Sheffield Corp., Dayton, O.

BURRING MACHINES
Ajax Mfg. Co., Euclid, Cleveland
Consolidated Mach. Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Hill Acme Co., Cleveland
National Broach & Machine Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

BUSHINGS, Drill
Carboloy Co., Detroit
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Metal Carbides Corp., Youngstown, O.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Steel (See LOCKERS & SHELVING)

CALIPERS & COMPASSES
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Farrel-Birmingham Co., Ansonia, Conn.
Lufkin Rule Co., Saginaw, Mich.
Randall & Stickney, Waltham, Mass.
Scherr Co., Geo., N. Y. C.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS, Machine
Brown & Sharpe Mfg. Co., Providence, R. I.
Cross Gear & Machine Co., Detroit
Hartford Special Machinery Co., Hartford, Conn.
Weldon Tool Co., Cleveland

CARBURIZERS (See also BOXES, Heat-Treating & Annealing)
American Gas Furn. Co., Elizabeth, N. J.
Houghton & Co., E. F., Philadelphia
Surface Combustion Corp., Toledo, O.

CARTRIDGE-CASE FINISHING MACHINES
Coulter Mach. Co., Jas., Bridgeport, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.

CASTINGS
American Brake Shoe & Fdry. Co., N. Y. C.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bunting Brass & Bronze Co., Toledo
Etna Machine Co., Toledo, O.
Hill Acme Co., Cleveland
Jefferson Mach. Tool Co., Cincinnati
Johnson Bronze Co., New Castle, Pa.
Mattison Machine Wks., Rockford, Ill.
Springfield Mach. Tool Co., Springfield, O.

CEMENT, Belt
Desmond-Stephan Mfg. Co., Urbana, O.
Houghton & Co., E. F., Philadelphia

CEMENT, Refractory
Carborundum Co., Niagara Falls, N. Y.
Norton Company, Worcester, Mass.

CENTERING MACHINES
Consolidated Mach. Tool Corp., Rochester, N. Y.
Hanson-Whitney Machine Co., Hartford, Conn.
Hendey Machine Co., Torrington, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Seneca Falls Mach. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Co., Rockford, Ill.

CENTERS, Bench
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., Dearborn, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Starrett Co., L. S., Providence, R. I.

CENTERS, Machine
Abrasive Mach. Tool Co., E. Providence, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Company, Bridgeport, Conn.
Carboloy Co., Detroit
Cincinnati Lathe & Tool Co., Cincinnati
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Hendey Machine Co., Torrington, Conn.
Knight Machinery Co., W. B., St. Louis
McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Sturdimatic Tool Co., Detroit
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.

CENTRIFUGALS (See PURIFIERS, Oil & Coolant)

CENTRIFUGAL MACHINERY
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.
Sparkler Mfg. Co., Mundelein, Ill.

CHAIN, Forged-Steel Link
American Chain & Cable Co., Bridgeport, Conn.
Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
McKay Co., Pittsburgh
Scully Steel Products Co., Chicago

CHAINS, Conveyor
Allis-Chalmers Mfg. Co., Milwaukee
American Chain & Cable Co., Bridgeport, Conn.

CHAINS, Transmission
Bilgram Gear & Mach. Wks., Philadelphia
Cincinnati Gear Co., Cincinnati
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland

CHAMFERING MACHINES
Bilgram Gear & Mach. Wks., Philadelphia
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Lipe-Rollway Corp., Syracuse, N. Y.
Murchey Machine & Tool Co., Detroit
National Broach & Mach. Co., Detroit
Sheffield Corp., Dayton, O.

CHECKS, Metal, Time and Tool
Acromark Co., Elizabeth, N. J.
Noble & Westbrook Mfg. Co., East Hartford, Conn.
Revere Copper & Brass Inc., N. Y. C.

CHISELS, Hand (See TOOLS, Hand)

CHISELS, Chipping, Pneumatic & Electric Hammer
Bethlehem Steel Co., Bethlehem, Pa.
Black & Decker Mfg. Co., Towson, Md.
Cleveland Pneumatic Tool Co., Cleveland
Plomb Tool Co., Los Angeles, Calif.
Scully-Jones & Co., Chicago

CHUCKING MACHINES (See also LATHES, Automatic & Semi-Automatic)
Bullard Co., Bridgeport, Conn.
Cincinnati Lathe & Tool Co., Cincinnati
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Foote-Burt Co., Cleveland
Gisholt Machine Co., Madison, Wis.
Gorton Mach. Co., George, Racine, Wis.
Goss & deLeeuw Mach. Co., New Britain, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Lees-Bradner Co., Cleveland
National Acme Co., Cleveland
New Britain-Gridley Mach. Div., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland
Wickman Corp., Detroit

CHUCKS, Air (See CHUCKS, Pneumatic)

CHUCKS, Collet (See Collets)

CHUCKS, Drill & Tap
Atlas Press Co., Kalamazoo, Mich.
Errington Mech. Lab., Stapleton, N. Y.
Etteo Tool Co., Brooklyn, N. Y.
Gisholt Machine Co., Madison, Wis.
Jacobs Mfg. Co., Hartford, Conn.
Lee & Son, K. O., Aberdeen, S. D.
McCrosky Tool Corp., Meadville, Pa.
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
North Bros. Mfg. Co., Philadelphia
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland

CHUCKS, Drill, Quick-Change, Collet
Errington Mech. Lab., Stapleton, N. Y.
Gairing Tool Co., Detroit
Modern Tool Works, Rochester, N. Y.
Scully-Jones & Co., Chicago

CHUCKS, Gear
Cushman Chuck Co., Hartford, Conn.
Gleason Works, Rochester, N. Y.
Sheffield Corp., Dayton, O.

CHUCKS, Hydraulic
Cross Gear & Machine Co., Detroit
Cushman Chuck Co., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
New Britain-Gridley Machine Div., New Britain, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Warner & Swasey Co., Cleveland

CHUCKS, Lathe
Atlas Press Co., Kalamazoo, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Cushman Chuck Co., Hartford, Conn.
Delta Mfg. Co., Milwaukee
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Harnischfeger Corp., Milwaukee
Hendey Machine Co., Torrington, Conn.
L-W Chuck Co., Toledo, O.
McCrosky Tool Corp., Meadville, Pa.
Potter & Johnston Machine Co., Pawtucket, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Boston
Scherr Co., Geo., N. Y. C.
Tomkins-Johnson Co., Jackson, Mich.

CHUCKS, Magnetic
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Heald Machine Co., Worcester, Mass.
L-W Chuck Co., Toledo, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S., Worcester, Mass.

CHUCKS, Motorized Electric
Cushman Chuck Co., Hartford, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.

PRODUCTION SPEEDERS

IDEAL
LIVE CENTERS
Turn Heavier Loads Faster

They *rotate with* the work—and thus permit heavier loads—faster speeds—deeper cuts! Radial load carried by high precision ball bearing, and thrust load absorbed by a taper roller bearing.

TRIPLE DUTY — 3 interchangeable center pieces for all centered and uncentered work. Save set-up time.

FREE Catalog of these and other Production Speeders

IDEAL COMMUTATOR DRESSER COMPANY
1057 PARK AVENUE SYCAMORE, ILLINOIS
SALES OFFICES IN ALL PRINCIPAL CITIES
In Canada: Irving Smith, Ltd., Montreal, Quebec

WHERE-TO-BUY DIRECTORY

Potter & Johnston Machine Co., Pawtucket, R. I.
Warner & Swasey Co., Cleveland

CHUCKS, Pneumatic
Cushman Chuck Co., Hartford, Conn.
Potter & Johnston Machine Co., Pawtucket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Warner & Swasey Co., Cleveland

CHUCKS, Ring-Wheel
Abrasive Mach. Tool Co., E. Providence, R. I.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Gardner Machine Co., Beloit, Wis.

CHUCKS, Spring
Brown & Sharpe Mfg. Co., Providence, R. I.
Harnischfeger Corp., Milwaukee
Rivett Lathe & Grinder, Inc., Boston

CLAMPS, Machinist's
Armstrong Bros. Tool Co., Chicago
Brown & Sharp Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
North Bros. Mfg. Co., Philadelphia
Williams & Co., J. H., Buffalo, N. Y.

CLEANERS, Metal (See **COMPOUNDS, Cleaning**)

CLEANING EQUIPMENT (See **METAL-CLEANING EQUIPMENT**)

CLOTH, Abrasive (See **PAPER & CLOTH, Abrasive**)

CLUTCHES, Friction
Ajax Mfg. Co., Euclid, Cleveland
Allis-Chalmers Mfg. Co., Milwaukee
Carlyle Johnson Machine Co., Manchester, Conn.
Errington Mech. Lab., Stapleton, N. Y.
Foote Bros. Gear & Machine Co., Chicago
Hill Acme Co., Cleveland, O.
Lipe-Rollway Corp., Syracuse, N. Y.
Morse Chain Co., Ithaca, N. Y.
Reeves Pulley Co., Indianapolis

COLLARS, Safety
American Pulley Co., Philadelphia
Carlyle Johnson Machine Co., Manchester, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLARS, Spacing
Atkins & Co., E. C., Indianapolis
Hill Acme Co., Cleveland
Morse Twist Drill & Machine Co., New Bedford, Mass.
Scully-Jones & Co., Chicago
Standard Pressed Steel Co., Jenkintown, Pa.

COLLECTORS, Dust
Blake Co., Edward, Newton Centre, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Covel Mfg. Co., Benton Harbor, Mich.
Torit Mfg. Co., St. Paul, Minn.

COLLETS
Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Lathe & Tool Co., Cincinnati
Cincinnati Milling Mach. Co., Cincinnati
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cushman Chuck Co., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hardinge Brothers, Inc., Elmira, N. Y.
Hendley Machine Co., Torrington, Conn.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland
National Auto. Tool Co., Richmond, Ind.
National Twist Drill & Mach. Co., Detroit
New Britain-Gridley Machine Co., New Britain, Conn.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Reed Prentice Co., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Stark Tool Co., Waltham, Mass.
Sundstrand Mach. Tool Co., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth, Mich.
Van Norman Mach. Tool Co., Springfield, Mass.
Warner & Swasey Co., Cleveland

COMPARATORS, Dial
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.

COMPARATORS, Gear-Tooth & Screw-Thread
Farrel-Birmingham Co., Buffalo, N. Y.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.
Vard, Inc., Pasadena, Calif.

COMPASSES, Metal-Scribing (See **CALIPERS & COMPASSES**)

COMPOUNDS, Cleaning
Bullard Co., Bridgeport, Conn.
Detroit Rex Products Co., Detroitt
Houghton & Co., E. F., Philadelphia
Magnus Chemical Co., Garwood, N. J.
Oakite Products, N. Y. C.
Turco Products, Inc., Los Angeles

COMPOUNDS, Drawing, Metal & Wire
Houghton & Co., E. F., Philadelphia
Shell Oil Co., Inc., N. Y. C.

COMPOUNDS, Grinding & Polishing
Carborundum Co., Niagara Falls, N. Y.
National Broach & Machine Co., Detroit
Norton Co., Worcester, Mass.

COMPOUNDS, Plastic Molding
Bakelite Corp., N. Y. C.
Dow Chemical Co., Midland, Mich.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

COMPOUNDS, Tempering & Case-Hardening
Houghton & Co., E. F., Philadelphia
Oakite Products, Inc., N. Y. C.
Strong, Carlisle & Hammond Co., Cleveland
Stuart Oil Co., D. A., Chicago

COMPRESSORS, Air & Gas
Allis-Chalmers Mfg. Co., Milwaukee
American Gas Furn. Co., Elizabeth, N. J.
Curtis Pneumatic Machy. Co., St. Louis
General Electric Co., Schenectady, N. Y.
Wright Mfg. Div. of Amer. Chain & Cable Co., York, Pa.

CONSULTANTS
Trundle Engrg. Co., Cleveland

CONTOUR MACHINES
Continental Machines, Inc., Minneapolis
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.

CONTRACT WORK (See also Index, last page)
Aluminum Co. of America, Pittsburgh
Baldwin Southwark Corp., Philadelphia
Bayard & Co., M. L., Philadelphia
Chapman-Valve Mfg. Co., Boston (Heat-Treating)
Chromium Corp. of Amer., N. Y. C. (Plating)
Continental Can Co., Inc., N. Y. C.
Eastern Machine Screw Corp., New Haven, Conn.
Elmes Engrg. Wks., Chas. F., Chicago
Ericcson Screw Machine Prod. Inc., Brooklyn, N. Y.
Excello Corp., Detroit (Heat-Treating)
Fenn Mfg. Co., Hartford, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hamilton Tool Co., Hamilton, O.
Hartford Special Machy. Co., Hartford, Conn.
Jefferson Mach. Tool Co., Cincinnati
Carlyle Johnson Machine Co., Manchester, Conn.
Kent-Owens Machine Co., Toledo, O.
Kropp Forge Co., Chicago (Forgings)
Liberty Tool & Gage Wks., Providence, R. I. (Jigs & Fixtures)
Meisel Press Mfg. Co., Boston
National Acme Co., Cleveland
National Twist Drill & Tool Co., Detroit
New Britain-Gridley Machine Co., New Britain, Conn. (Screw Machine Products)
Revere Copper & Brass, Inc., N. Y. C. (Forgings)
Stewart Iron Wks. Co., Inc., Cincinnati
Surface Combustion Corp., Toledo, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
United Chromium, Inc., N. Y. C., (Plating)
Vard, Inc., Pasadena, Calif.
Waltham Watch Co., Waltham, Mass.
Watson-Stillman Co., Roselle, N. J.
Williams & Co., J. H., Buffalo, N. Y.

CONTROLLERS, Motor
Allen-Bradley Co., Milwaukee
Allis-Chalmers Mfg. Co., Milwaukee
Clark Controller Co., Cleveland
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland
Square D Co., Milwaukee
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

CONTROLLERS, Pressure & Temperature
American Gas Furn. Co., Elizabeth, N. J.
Brown Instrument Co., Philadelphia
Lindberg Engrg. Co., Chicago

CONTROLS, Flexible-Shaft (See **SHAFTS, Flexible**)

CONTROLS, Furnace
American Gas Furn. Co., Elizabeth, N. J.
Brown Instrument Co., Philadelphia
Lindberg Engrg. Co., Chicago
Strong, Carlisle & Hammond Mach. Co., Cleveland

CONTROLS, Hydraulic
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit
Watson-Stillman Co., Roselle, N. J.

CONVEYORS
Allis-Chalmers Mfg. Co., Milwaukee
Mathews Conveyor Co., Ellwood City, Pa.
Standard Conveyor Co., N. St. Paul, Minn.

COOLANT SYSTEMS, Portable
Gray Mills Co., Chicago

COOLANTS, Cutting, Drilling & Grinding
Carborundum Co., Niagara Falls, N. Y.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
Oakite Products, Inc., N. Y. C.
Shell Oil Co., Inc., N. Y. C.
Socony-Vacuum Oil Co., Inc., N. Y. C.
Standard Oil Co. of Ind., Chicago
Stuart Oil Co., Ltd., D. A., Chicago
Sun Oil Co., Philadelphia
Swan-Finch Oil Corp., N. Y. C.
Tidewater Associated Oil Co., N. Y. C.

COUNTERBORES
Barnes Drill Co., Rockford, Ill.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Haynes Stellite Co., N. Y. C.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Wendt Sonis Co., Hannibal, Mo.

COUNTERSHAFTS
American Tool Works Co., Cincinnati
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Lathe & Tool Co., Cincinnati
Earle Gear & Mach. Co., Philadelphia
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.
Hill Acme Co., Cleveland
LeBlond Mach. Tool Co., R. K., Cincinnati

Characteristic of the design of all STURDIMATIC LIVE CENTERS is a low overhang and a slight cushioning action . . .
that compensates for expansion due to heat, shock and excessive thrust loads—reducing wear to a minimum. A properly engineered live center is one of the fundamentals of setting up a job and requires a specialist's experience . . . standard shanks with Morse taper carried in stock.

Send us your specifications and blueprints—We will see that your job is set up with the right LIVE CENTER—prompt deliveries on high priorities.

STURDIMATIC
TOOL COMPANY
5214 THIRD AVE. DETROIT, MICH.

Investigate

THE POSSIBILITIES OF THE NATIONAL KEYSEATING MILLER *on Your Work*

• Shops all over the country are solving difficult keyseating problems by chucking this attachment on their drill presses, radials and horizontal boring mills — and milling keyseats in pieces too large or bulky for convenient handling on keyseating machines.

The "National" goes through the hole once and mills keyseats with parallel sides and parallel with the axis of the bore. It's a big time and money saver and is available in standard stock diameters from ½" to 3½" for cutting lengths from 1⅞" to 12". It will keyseat in blind holes, taper holes, and offset holes. We also manufacture oil-grooving millers.

Several widths of cutters can be used with each size miller and many different hole diameters keyseated with one tool through the use of eccentric bushings.

WRITE today for Catalog No. 15

NATIONAL MACHINE TOOL CO.
CINCINNATI, OHIO

Carbide and Diamond-tipped
GAGES AND TOOLS
GUARANTEED QUALITY

ARTHUR A. *Crafts* COMPANY, INC.
Chicago 532 COMMONWEALTH AVE. *Detroit*
Boston

Die-Making Machines

They save 50% on sawing, filing and lapping operations, easily maintaining .002" limits. Ask for special bulletin —also circulars on Drill pointers, Point Thinners, Mill cutter Grinders and Tap Grinders.

OLIVER OF ADRIAN PRODUCTS

Oliver Instrument Co., 1414 Maumee St., Adrian, Mich.

For cutting internal keyways, slots or splines 1/16" to 4" wide and up to 60" long. Fast—Accurate—Flexible. Write for particulars and catalog on machine for your work.

Giant KEYSEATERS

MITTS & MERRILL
913 Tilden St.
Saginaw, Michigan

WHERE-TO-BUY DIRECTORY

Rivett Lathe & Grinder, Inc., Boston
Stow Mfg. Co., Binghamton, N. Y.
Warner & Swasey Co., Cleveland

COUNTERSINKS (See **DRILLS, Twist**)

COUNTERS, Revolution & Stroke
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.

COUPLINGS, Hose
Cleveland Pneu. Tool Co., Cleveland
Schrader's Son, A., Brooklyn, N. Y.

COUPLINGS, Shaft, Flexible
Allis-Chalmers Mfg. Co., Milwaukee
Delta Mfg. Co., Milwaukee
Earle Gear & Mach. Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Foote Bros. Gear & Mach. Co., Chicago
Hill Acme Co., Cleveland
Morse Chain Co., Ithaca, N. Y.
Nicholson & Co., W. H., Wilkes-Barre, Pa.

COUPLINGS, Shaft, Non-Flexible
General Electric Co., Schenectady, N. Y.
Hill Acme Co., Cleveland
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Jib
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Cleveland Crane & Engrg. Co., Wickliffe, O.
Curtis Pneumatic Machy. Co., St. Louis
Harnischfeger Corp., Milwaukee
Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

CRANES, Portable
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

CRANES, Overhead Traveling
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Cleveland Crane & Engrg. Co., Wickliffe, O.
Curtis Pneumatic Machry. Co., St. Louis
Harnischfeger Corp., Milwaukee
Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

CUSHIONS, Die
V & O. Press Co., Hudson, N. Y.

CUTTERS, Angle
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
McCrosky Tool Co., Meadville, Pa.
McKenna Metals Co., Latrobe, Pa.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago

CUTTERS, Die-Sinking
Detroit Tap & Tool Co., Detroit
Gairing Tool Co., Detroit
Gorton Machine Co., Geo., Racine, Wis.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.

CUTTERS, Formed
Atkins & Co., E. C., Indianapolis
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Detroit
Cleveland Twist Drill Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Detroit Tap & Tool Co., Detroit
Disston & Sons, Inc., Henry, Philadelphia
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Weldon Tool Co., Cleveland

CUTTERS, Gear
Adams Co., Dubuque, Iowa
Bantam Bearings Corp., S. Bend, Ind.
Barber-Colman Co., Rockford, Ill.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Hobbing Mach. Co., Cleveland
Cross Gear & Machine Co., Detroit
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Scherr Co., Geo., N. Y. C.
Standard Tool Co., Cleveland
Stow Mfg. Co., Binghamton, N. Y.
Taylor Machine Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Waltham Mach. Wks., Waltham, Mass.

CUTTERS, Hand Pipe (See **STOCKS, DIES & CUTTERS, Pipe**)

CUTTERS, Keyseater
Baker Bros., Inc., Toledo, O.
Barber-Colman Co., Rockford Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Colonial Broach Co., Detroit
Davis Keyseater Co., Rochester, N. Y.
Ex-Cell-O Corp., Detroit
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Mitts & Merrill, Saginaw, Mich.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
National Machine Tool Co., Cincinnati
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

CUTTERS, Milling
Adams Company, Dubuque, Ia.
Atlas Press Co., Kalamazoo, Mich.
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Crafts Co., Inc., Arthur A., Boston
Detroit Tap & Tool Co., Detroit
Disston & Sons, Inc., Henry, Philadelphia
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Gorton Mach. Co., George, Racine, Wis.
Grayson Mfg. Co., Monrovia, Calif.
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Kearney & Trecker Corp., Milwaukee
Lovejoy Tool Co., Inc., Springfield, Vt.
McCrosky Tool Corp., Meadville, Pa.
McKenna Metals Co., Latrobe, Pa.
Michigan Tool Co., Detroit
Modern Tool Works, Rochester, N. Y.
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
O. K. Tool Co., Shelton, Conn.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Vaseoloy-Ramet Corp., N. Chicago, Ill.
Waltham Mach. Wks., Waltham, Mass.

WHERE-TO-BUY DIRECTORY

Weldon Tool Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.
Williams & Co., J. H. Buffalo, N. Y.

CUTTERS, Wire
Ideal Commutator Dresser Co., Chicago

CUTTING-OFF MACHINES (See **SAWS**)

CUTTING-OFF MACHINES, Abrasive-Wheel
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Campbell Div., Andrew C., American Chain & Cable Co., Bridgeport, Conn.
deSanno & Sons, Inc., A. P., Philadelphia
Porter McLeod Machine Tool Co., Inc., Hatfield, Mass.
Racine Tool & Mach. Co., Racine, Wis.

CYLINDERS, Air (See **TANKS & CYLINDERS, Air**)

CYLINDERS, Hydraulic (See **PRESSES, Hydraulic**)

DEALERS, Machinery (See **Searchlight Section**)

DEGREASERS (See **Metal Cleaning Equipment**)

DEMAGNETIZERS
Abrasive Machine Tool Co., E. Providence, R. I.
Blanchard Mach. Co., Cambridge, Mass.
L-W Chuck Co., Toledo, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S., Worcester, Mass.

DIAMONDS, Industrial
Carboloy Co. Inc., Detroit
Crafts Co., Inc., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana, O.
Diamond Tool Co., Chicago
Smit & Sons, Inc., J. K., N. Y. C.

DIE-CASTING MACHINES
Continental Machines, Inc., Minneapolis
Reed-Prentice Corp., Worcester, Mass.

DIE-HEADS, Threading
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Chaso Tool Co., Royal Oak, Mich.
Eastern Machine Screw Corp., New Haven, Conn.
Errington Mech. Lab., Stapleton, N. Y.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap and Die Corp., Greenfield, Mass.
Hill Acme Co., Cleveland
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
Oster Mfg. Co., Cleveland
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Warner & Swasey Co., Cleveland

DIE-MAKERS' SUPPLIES
Baumbach Mfg. Co., E. A., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Inc., Detroit
Danly Mach. Specialties, Inc., Chicago
Dykem Co., St. Louis
Lufkin Rule Co., Saginaw, Mich.
Masonite Corp., Chicago
Producto Mach. Co., Bridgeport, Conn.
Starrett Co., L. S., Athol, Mass.

DIE-MAKING & CUTTING MACHINES
Cincinnati Milling Mach. Co., Cincinnati
Continental Machines, Inc., Minneapolis
Gorton Machine Co., Geo., Racine, Wis.
Henry & Wright Mfg. Co., Hartford, Conn.
Illinois Tool Works, Chicago
Johnson Tool Co., E. Providence, R. I.
Peerless Machine Co., Racine, Wis.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Reed-Prentice Co., Worcester, Mass.

DIE-SETS
Baumbach Mfg. Co., E. A., Chicago
Card Mfg. Co., S. W., Mansfield, Mass.
Danly Mach. Specialties, Inc., Chicago
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

DIE-SINKING MACHINES
Cincinnati Milling Mach. Co., Cincinnati
Gorton Machine Co., Geo., Racine, Wis.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Reed-Prentice Corp., Worcester, Mass.

DIES, Marking & Embossing
Acromark Co., Elizabeth, N. J.
Cunningham Co., M. E., Pittsburgh
Matthews & Co., Jas. H., Pittsburgh
Noble & Westbrook Mfg. Co., East Hartford, Conn.

DIES, Screw-Cutting, Adjustable
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Eastern Machine Screw Corp., New Haven, Conn.
Errington Mech. Lab., Stapleton, N. Y.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Threadwell Tap & Die Co., Greenfield, Mass.

DIES, Sheet-Metal & Forging
Hamilton Tool Co., Hamilton, O.
Scully-Jones & Co., Chicago
Taft-Peirce Mfg. Co., Woonsocket, R. I.

DIES, Solid Bolt & Pipe
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Consolidated Machine Tool Corp., Rochester, N. Y.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Warner & Swasey Co., Cleveland

DIES, Sub-Press
Baumbach Mfg. Co., E. A., Chicago
Danly Mach. Specialties, Inc., Chicago
Producto Machine Co., Bridgeport, Conn.
V & O Press Co., Hudson, N. Y.
Waltham Mach. Works, Waltham, Mass.

DIES, Wire-Drawing & Extrusion
Carboloy Co., Inc., Detroit
Crafts Co., Arthur A., Boston
Firth-Sterling Steel Co., McKeesport, Pa.
Illinois Tool Works, Chicago
Metal Carbides Corp., Youngstown, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vascoloy-Ramet Corp., N. Chicago, Ill.

DISKS, Abrasive (See **WHEELS, Grinding & Polishing**)

DISKS, Circular Cutting
Atkins & Co., E. C., Indianapolis
Disston & Sons, Inc., Henry, Philadelphia
Morse Twist Drill and Machine Co., New Bedford, Mass.

DIVIDERS (See **CALIPERS & COMPASSES**)

DOGS, Lathe & Milling-Machine
Armstrong Bros. Tool Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Hendey Machine Co., Torrington, Conn.
LeBlond Mach. Tool Co., R. K., Cincinnati
Ready Tool Co., Bridgeport, Conn.
Sturdimatic Tool Co., Detroit
Williams & Co., J. H., Buffalo, N. Y.

DRESSERS, Grinding Wheel
American Swiss File & Tool Co., Elizabeth, N. J.
Atkins & Co., E. C., Indianapolis
Black & Decker Mfg. Co., Towson, Md.
Carboloy Co., Inc., Detroit
Carborundum Co., Niagara Falls, N. Y.
Chicago Wheel & Mfg. Co., Chicago
Crafts Co., Inc., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana, O.

DIAMOND WHEELS for CARTRIDGE DIES

JKS resinoid-bonded Diamond Wheels for internal grinding of tungsten steel cartridge dies, produce straight holes of mirror-like finish, accurately, speedily and economically. Roughing and finishing wheel diameter 7/16 in.; length 3/8 in.; bore 1/8 in. Special sizes to order. Consult a JKS representative or write for folder.

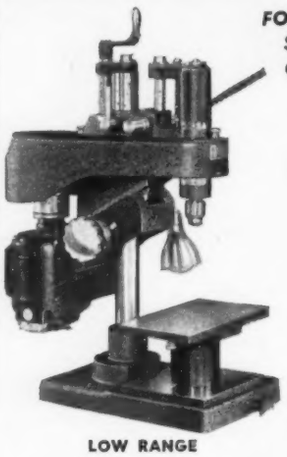
Prompt deliveries

J. K. SMIT & SONS, INC.
157 Chambers Street, New York

SECOMET Resinoid Bonded Diamond Wheels can do your work more accurately, faster and without appreciable wear. They are most economical for sharpening cemented carbide and multi-bladed tools, such as milling cutters, broaches, etc. Moreover, their sharp, free-cutting action eliminates lapping and the usual semi-finish grinding operation. Catalog on request.

Prompt deliveries

J. K. SMIT & SONS, INC.
157 Chambers Street, New York



FOR GREATER SPEED RANGE, SENSITIVITY AND EASE OF OPERATION . . .

HAMILTON-MUEHLMATT "VARIMATIC"

. . . SUPER SENSITIVE, VARIABLE SPEED DRILLING MACHINES!

★

LOW RANGE
Min. Spindle Speed 840 — Max. Spindle Speed 2700

HIGH RANGE —
2930 — 9300

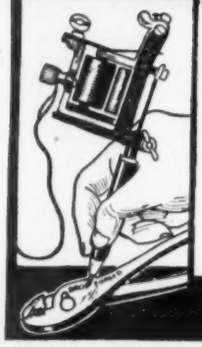
DRILL CAPACITY
.004" to 5/16"

Here's a unit built with "instrument precision", fully capable of handling the finest work for both defense and peacetime production. Combining sensitive and ease of operation, the "VARI-MATIC" allows instantaneous, variable speed adjustment in two ranges. (Speed changes are accomplished by means of a hand wheel. A graduated dial on hand wheel shows the speed at which the spindle is operating.) A letter will bring complete details—write!

The Hamilton Tool Co.

830 NINTH ST. · HAMILTON, OHIO

MOORE'S ELECTRO-GRAVER



THE OLD RELIABLE

Diamond Point Equipped

TOOL MARKER

ENGRAVES ALMOST ANY MATERIAL INCLUDING HARDEST STEEL

Unlike Arcing Devices—Not Limited to Bare Metals—Works From 110-120 V. 60 Cycle A.C. Current Through a Reducing Transformer—(Not Shown Here) In Use by Largest Concerns

SEND FOR LITERATURE NOW

WILLIAM MOORE MFG. CO.
631 South State Street — Chicago, Illinois

WHERE-TO-BUY DIRECTORY

Disston & Sons, Inc., Henry, Philadelphia
Dumore Co., Racine, Wis.
Ideal Commutator Dresser Co., Chicago
Lee & Son, K. O., Aberdeen, S. D.
Metal Carbides Corp., Youngstown, O.
Norton Co., Worcester, Mass.
Schultz & Anderson Co., Newark (Radius)
Smit & Sons, J. K., N. Y. C.
Standard Tool Co., Cleveland
Victor Machinery Exchange, N. Y. C.

DRESSING, Belt
Houghton & Co., E. F., Philadelphia
Tide Water Associated Oil Co., N. Y. C.
White & Bagley, Worcester, Mass.

DRIERS, Centrifugal
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.

DRIFTS, Drill
Armstrong Bros. Tool Co., Chicago
Cleveland Twist Drill Co., Cleveland
Morse Twist Drill & Machine Co., New Bedford, Mass.
Standard Tool Co., Cleveland

DRILLROD, Steel Tool (See STEEL, Tool)

DRILLS, Automatic & Semi-Automatic
Avey Drilling Machine Co., Cincinnati
Baker Bros., Inc., Toledo, O.
Barnes Co., W. F., & John, Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Bodine Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati Gilbert Machine Tool Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Cross Gear and Machine Co., Detroit
Davis & Thompson Co., Milwaukee
Ex-Cell-O Corp., Detroit
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Goss & deLeeuw Machine Co., New Britain, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Kingsbury Mach. Tool Co., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
North Bros. Mfg. Co., Philadelphia
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.

DRILLS, Bench
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Barnes Co., W. F. & John, Rockford, Ill.
Black & Decker Mfg. Co., Towson, Md.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati
Delta Mfg. Co., Milwaukee
Dumore Co., Racine, Wis.
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Hamilton Tool Co., Hamilton, O.
Henry & Wright Mfg. Co., Hartford, Conn.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
North Bros. Mfg. Co., Philadelphia
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Ryerson & Son, Jos. T., Chicago
Schauer Mach. Co., Cincinnati
Skilsaw, Inc., Chicago
Walker-Turner Co., Plainfield, N. J.

DRILLS, Breast (See TOOLS, Hand)

DRILLS, Center
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill and Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Co., Div. Niles-Bement-Pond Co., Hartford, Conn.
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Victor Machinery Exchange, N. Y. C.

DRILLS, Column-Type
Atlas Press Co., Kalamazoo, Mich.
Baker Bros., Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati Gilbert Machine Tool Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Dalzen Tool & Mfg. Co., Detroit
Davis & Thompson Co., Milwaukee
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
General Machy. Corp., Hamilton, O.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
Snyder Tool & Engrg. Co., Detroit

DRILLS, Core
Carboloy Co., Inc., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Haynes Stellite Co., N. Y. C.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Wendt Sonis Co., Hannibal, Mo.

DRILLS, Flat (See DRILLS, Twist & Flat)

DRILLS, Hand (See TOOLS, Hand)

DRILLS, Horizontal
Avey Drilling Machine Co., Cincinnati
Baker Bros. Inc., Toledo, Ohio.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bradford Machine Tool Co., Cincinnati
Buhr Mach. Tool Co., Ann Arbor, Mich.
Cincinnati Gilbert Machine Tool Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Kingsbury Mach. Tool Co., Keene, N. H.

"Anti-friction Bearings Throughout"

—SPECIAL FEATURES—

1—LOW HUNG DRIVE TO THE SPINDLE 2—ALL POWER DRIVEN PARTS RUNNING IN OIL 3—QUIET RUNNING AT ALL SPEEDS 4—CONCENTRATED AND CONVENIENT CONTROLS 5—CONSTRUCTED ON UNIT PRINCIPLE

The CARLTON

MACHINE TOOL COMPANY

CINCINNATI, OHIO, U. S. A.

WHERE-TO-BUY DIRECTORY

Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Murchey Machine and Tool Co., Detroit
National Auto. Tool Co., Richmond, Ind.
Ryerson & Son, Jos. T., Chicago
Sellers & Co., Inc., Wm., Philadelphia
Snyder Tool & Engrg. Co., Detroit
Universal Boring Mach. Co., Hudson, Mass.

DRILLS, Deep-Hole
Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

DRILLS, Multi-Spindle or Gang
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Baker Bros. Inc., Toledo, O.
Barnes Co., W. F. & John, Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bodine Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Buhr Mach. Tool Co., Ann Arbor, Mich.
Bullard Co., Bridgeport, Conn.
Cincinnati Bickford Tool Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Davis & Thompson Co., Milwaukee
Delta Mfg. Co., Milwaukee
Ex-Cell-O Corp., Detroit
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hamilton Tool Co., Hamilton, O.
Henry & Wright Mfg. Co., Hartford, Conn.
Kingsbury Mach. Tool Co., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Geo., N. Y. C.
Snyder Tool & Engrg. Co., Detroit

DRILLS, Portable Electric (See **TOOLS, Portable Electric**)

DRILLS, Portable Pneumatic (See **TOOLS, Portable Pneumatic**)

DRILLS, Radial
American Tool Works Co., Cincinnati
Bryant Machinery & Engrg. Co., Chicago
Carlton Machine Tool Co., Cincinnati
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati Gilbert Mach. Tool Co., Cincinnati
Cleveland Punch & Shear Works, Inc., Cleveland
Fosdick Machine Tool Co., Cincinnati
General Machy. Corp., Hamilton, O.
Leland-Gifford Co., Worcester, Mass.
Morris Machine Tool Co., Cincinnati

DRILLS, Sensitive
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Barnes Co., W. F. & John, Rockford, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Buhr Mach. Tool Co., Ann Arbor, Mich.
Dalzen Tool & Mfg. Co., Detroit
Delta Mfg. Co., Milwaukee
Dumore Co., Racine, Wis.
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Hamilton Tool Co., Hamilton, O.
Henry & Wright Mfg. Co., Hartford, Conn.
Kingsbury Mach. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
National Auto. Tool Co., Richmond, Ind.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Scherr Co., Geo., N. Y. C.
Walker-Turner Co., Inc., Plainfield, N. J.

DRILLS, Twist & Flat
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Victor Machinery Exchange, N. Y. C.

DRIVES, Machine
Cincinnati Lathe & Tool Co., Cincinnati
Dayton Rubber Mfg. Co., Dayton, O.
Drive-All Mfg. Co., Detroit
General Electric Co., Schenectady, N. Y.
Hardinge Brothers, Inc., Elmira, N. Y.
Reed-Prentice Co., Worcester, Mass.
Reliance Elec. & Engrg. Co., Cleveland
Rivett Lathe & Grinder, Inc., Boston
Sheldon Mach. Co., Chicago
Turner Machinery Co., Kansas City, Mo.

DRIVES, Variable-Speed (See **TRANSMISSIONS, Variable-Speed**)

DRIVES, "V"-Belt
Allis-Chalmers Mfg. Co., Milwaukee
American Pulley Co., Philadelphia
Dayton Rubber Mfg. Co., Dayton, O.
Gates Rubber Co., Denver, Colo.

DRIVES, Worm
Adams Company, Dubuque, Iowa
Bilgram Gear & Mach. Wks., Philadelphia
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Earle Gear & Mach. Co., Philadelphia
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
Grant Gear Works, Boston
Michigan Tool Co., Detroit
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia

DRYING Machines (See **MACHINES, Washing and Drying**)

ELECTRODES, Welding
Air Reduction, N. Y. C.
Aluminum Co. of America, Pittsburgh
American Brass Co., Waterbury, Conn.
American Steel & Wire Co., Cleveland
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., Milwaukee
Haynes-Stellite Co., N. Y. C.
Lee & Son, K. O., Aberdeen, S. D.
Lincoln Electric Co., Cleveland
McKay Co., Pittsburgh, Pa.
Page Steel & Wire Div., Am. Chain & Cable Co., Monessen, Pa.
Roebling's Sons Co., John A., Trenton, N. J.
Ryerson & Son, Inc., Jos. T., Chicago
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

ENAMELING & GALVANIZING MACHINES, Centrifugal
Barrett Co., Leon J., Worcester, Mass.

ENAMELS (See **PAINTS, VARNISHES, etc.**)

ENGRAVING MACHINES
Gorton Machine Co., Geo., Racine, Wis.
Ideal Commutator Dresser Co., Chicago
Moore Mfg. Co., Wm., Chicago
Preis Engraving Mach. Co., H. P., Newark, N. J.
Reed-Prentice Co., Worcester, Mass.

EXTRACTORS, Centrifugal Oil (See **SEPARATORS, Centrifugal**)

EXTRACTORS, Screw
Cleveland Twist Drill Co., Cleveland
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Standard Tool Co., Cleveland

FANS, Man-Cooler (See **BLOWERS**)

FEEDS, Die (See **FEEDS, Press**)

FEEDS, Hydraulic
American Engineering Co., Philadelphia
Ex-Cell-O Tool Corp., Detroit
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit

FEEDS, Press
Federal Press Co., Elkhart, Ind.
Henry & Wright Mfg. Co., Hartford, Conn.
Nilson Mach. Co., A. H., Bridgeport, Conn.
Producto Machine Co., Bridgeport, Conn.
Schrader's Sons, A., N. Y. C.
V. & O. Press Co., Hudson, N. Y.
Yoder Co., Cleveland
Zeh & Hahnemann Co., Newark, N. J.

FILE BANDS
Do All Co., Inc., Des Plaines, Ill.

FILES & RASPS
American Swiss File & Tool Co., Elizabeth, N. J.
Atkins & Co., E. C., Indianapolis

Keeping WAR PRODUCTION Moving

DESMOND DRESSERS and CUTTERS

DESMOND-dressed grinding wheels cut faster . . . last longer . . . keep production on the move. In plants throughout the country, you'll find these superior tools doing their part. With the only *complete* line of Dressers and Cutters, *DESMOND can meet your needs*—all types and sizes. Get them from your distributor—write for his name.

★

Built to take it! That's the SIMPLEX Steel Slide VISE. On production jobs that mean 24-hour-a-day service, the qualities of the exclusive SIMPLEX Steel Slide mean greater strength . . . longer life. In many sizes and types — machinists', welders', pipe, etc. There's a distributor in your territory—write for his name!

SIMPLEX STEEL SLIDE VISES

The DESMOND-STEPHAN Mfg. Co.
URBANA, OHIO
The Canadian Desmond-Stephan Manufacturing Company, Hamilton, Ont.

GILBERT

PRODUCTION SPEEDING RADIAL DRILLS AND HORIZONTAL DRILLING, BORING AND MILLING MACHINES

DETAILS ON REQUEST

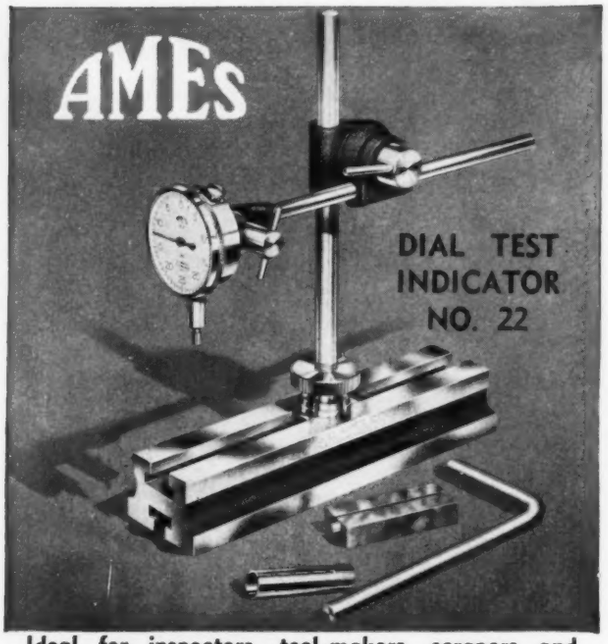
THE CINCINNATI GILBERT MACHINE TOOL CO.
CINCINNATI, OHIO

For Precision Marking In War Production . . .
THE PANTO ENGRAVER, ELECTRICAL MARKER, AND ACID ETCHER

A compact precision bench-type pantographic machine, with interchangeable heads . . . for engraving instrument dials, name plates, etc. . . . and for acid etching or electrically marking aircraft engine parts—heat-treated or annealed—on flat, concave, or convex surfaces. Illustration shows engraving head attached.

» *Write for Literature*

H. P. PREIS ENGRAVING MACHINE COMPANY
159B Summit Street — Newark, New Jersey



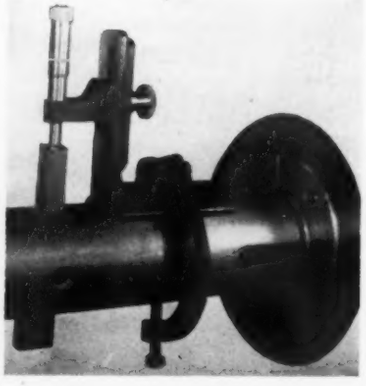
Ideal for inspectors, tool-makers, scrapers and assemblers to test in thousandths, half-thousandths or tenths of thousandths inches. Adjustable to all positions and used in tool holders of various machines. Priced at $30.

Send for bulletin

B. C. AMES CO., WALTHAM, MASS.

The BARTELT *TOOL SETTING GAGE*

Shops engaged in war production need the speed and accuracy they make possible in setting Boring Tools



★

The BARTELT Tool Setting Gage eliminates guesswork in setting tools not equipped with micrometer instruments. You clamp the Tool Setting Gage to the boring bar, use the slide to bring micrometer to top of cutter, back off micrometer to number of thousandth required to bore to size, adjust cutter to micrometer and fasten it, remove gage and . . . go to work. The gage may be had with either a micrometer or dial indicator. Enjoy the saving the BARTELT Tool Setting Gage makes possible on tool setting and related applications—get complete information now.

BARTELT ENGINEERING CO. 1214 PARTRIDGE AVE. BELOIT, WISCONSIN

WHERE-TO-BUY DIRECTORY

Disston & Sons, Inc., Henry, Philadelphia
Nicholson File Co., Providence, R. I.
Oliver Instrument Co., Adrian, Mich.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Inc., Binghamton, N. Y.
Strand & Co., N. A., Chicago

FILES, Rotary
Disston & Sons, Inc., Henry, Philadelphia
Hamilton Tool Co., Hamilton, O.
Strand & Co., N. A., Chicago

FILING MACHINES, Die
Ames Co., B. C., Waltham, Mass.
Continental Machines Inc., Milwaukee
Do All Co., Inc., Des Plaines, Ill.
Illinois Tool Co., Chicago
Oliver Instrument Co., Adrian, Mich.

FILTERS, Air
Cleveland Pneu. Tool Co., Cleveland
Curtis Pneu. Machy. Co., St. Louis
Norton Company, Worcester, Mass.

FILTERS, Oil & Coolant
Metal Textile Corp., Orange, N. J.

FINGERS, Feed
Eastern Machine Screw Corp., New Haven, Conn.
Hardinge Brothers, Inc., Elmira, N. Y.
Mitts & Merrill, Saginaw, Mich.
Rivett Lathe & Grinder, Inc., Boston

FITTINGS, Hydraulic
Watson-Stillman Co., Roselle, N. J.

FITTINGS, Wire-Rope
American Chain & Cable Co., Bridgeport, Conn.
American Steel & Wire Co., Chicago
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Cleveland
Roebling's Sons Co., John A., Trenton, N. J.

FIXTURES, Indexing
Brown & Sharpe Mfg. Co., Providence, R. I.
Hartford Special Machinery Co., Hartford, Conn.
Jefferson Mach. Tool Co., Cincinnati

FLAME-CUTTING MACHINES
Air Reduction, N. Y. C.
Oster Mfg. Co., Cleveland

FLEXIBLE SHAFT EQUIPMENT
Foredom Electric Co., N. Y. C.
Haskins Mfg. Co., R. G., Chicago
Strand Mfg. Co., N. A., Chicago

FLUX, Liquid & Paste
Air Reduction, N. Y. C.
Atkins & Co., E. C., Indianapolis
Eutectic Welding Alloys, Inc., N. Y. C.
Lincoln Electric Co., Cleveland

FORGES
Buffalo Forge Co., Buffalo, N. Y.

FORGING MACHINES (See also **PRESSES, Forging**)
Ajax Mfg. Co., Euclid, Cleveland
Elmes Engrg. Wks., Chas. F., Chicago
Hill-Acme Co., Cleveland

FORGINGS (See **Contract Work**)

FORMING MACHINES
Ajax Mfg. Co., Euclid, Cleveland
Cincinnati Shaper Co., Cincinnati
Cleveland Punch & Shear Wks., Cleveland
Consolidated Mach. Tool Corp., Rochester, N. Y.
Elmes Engrg. Works, Chas. F., Chicago
Farrel-Birmingham Co., Ansonia, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Nilson Machine Co., A. H., Bridgeport, Conn.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Watson-Stillman Co., Roselle, N. J.
Yoder Co., Cleveland
Zeh & Hahnemann Co., Newark, N. J.

FURNACES, Electric
Electric Furnace Co., Salem, O.
General Electric Co., Schenectady, N. Y.
Lindberg Engineering Co., Chicago
Surface Combustion Corp., Toledo, O.
Westinghouse Electric & Mfg. Co., E. Pittsburgh

FURNACES, Gas
American Gas Furn. Co., Elizabeth, N. J.
Chicago Flexible Shaft Co., Chicago
Electric Furnace Co., Salem, Ohio
Hones, Inc., Chas. A. Baldwin, N. Y.
Lindberg Engineering Co., Chicago
Stark Tool Co., Waltham, Mass.
Strong, Carlisle & Hammond Co., Cleveland
Surface Combustion Corp., Toledo, O.

FURNACES, Oil
Chicago Flexible Shaft Co., Chicago
Electric Furnace Co., Salem, O.
Surface Combustion Corp., Toledo

FURNITURE, Shop
Black & Decker Mfg. Co., Towson, Md. (Drill Stands)
Hamilton Tool Co., Hamilton, O.
New Britain-Gridley Machine Co., New Britain, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

GAGES, Amplifying
Federal Products Corp., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.
Scherr Co., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.

GAGES, Caliper
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Comparator
Ames Co., B. C. Waltham, Mass.
Federal Products Corp., Providence, R. I.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Continental Machines, Inc., Minneapolis
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.

GAGES, Dial
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Comtor Co., Waltham, Mass.
Federal Products Corp., Providence, R. I.
Randall & Stickney, Waltham, Mass.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Drill-Center
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Morse Twist Drill Co., New Bedford, Mass.
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Starrett Co., L. S., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

GAGES, Height
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis
Lufkin Rule Co., Saginaw, Mich.
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.

GAGES, Plug & Ring
Brown & Sharpe Mfg. Co., Providence, R. I.
Cadillac Gage Co., Detroit
Carboloy Co., Detroit
Comtor Co., Waltham, Mass.
Crafts Co., Inc., Arthur A., Boston
Detroit Tap & Tool Co., Detroit
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.

WHERE-TO-BUY DIRECTORY

Hanson-Whitney Machine Co., Hartford, Conn.
Lincoln Park Tool & Gage Co., Lincoln Park, Mich.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T., Providence, R. I.
Standard Gage Co., Poughkeepsie, N. Y.
Taft-Pierce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.

GAGES, Pressure
Baldwin-Southwark Corp., Philadelphia
Brown Instrument Co., Philadelphia

GAGES, Profile
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Snap (See **GAGES, Plug & Ring**)

GAGES, Surface
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

GAGES, Thickness
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Randall & Stickney Co., Waltham, Mass.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread
Brown & Sharpe Mfg. Co., Providence, R. I.
Cadillac Gage Co., Detroit
Detroit Tap & Tool Co., Detroit
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Mach. Co., Hartford, Conn.
Lufkin Rule Co., Saginaw, Mich.
Michigan Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T. Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.

GAGES, Tool Setting
Bartelt Engineering Co., Detroit

GAGES, Wire
Atkins & Co., E. C., Indianapolis
Brown & Sharpe Mfg. Co., Providence, R. I.
Disston & Sons, Inc., Henry, Philadelphia
Federal Products Corp., Providence, R. I.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Standard Tool Co., Cleveland
Starrett Co., L. S., Athol, Mass.

GALVANIZING MACHINES (See ENAMELING & GALVANIZING MACHINES)

GASES, Compressed
Air Reduction, N. Y. C.

GEAR-CUTTING MACHINES
Adams Co., Dubuque, Iowa
Barber-Colman Co., Rockford, Ill.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Hobbing Mach. Co., Cleveland
Colonial Broach Co., Detroit
Cross Gear & Machine Co., Detroit
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
General Mach. Corp., Hamilton, O.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
Newark Gear Cutting Mach. Co., Newark
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Waltham Mach. Wks., Waltham, Mass.

GEAR-TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.

GEARS, Cast
Braun Gear Corp., Brooklyn, N. Y.
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Ansonia, Conn.
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
General Electric Co., Schenectady, N. Y.
Grant Gear Works, Inc., Boston
Ohio Gear Co., Cleveland
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia

GEARS, Cut
Adams Co., Dubuque, Iowa
Allis-Chalmers Mfg. Co., Milwaukee
Baush Mach. Tool Co., Springfield, Mass.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Braun Gear Corp., Brooklyn, N. Y.
Carlyle Johnson Machine Co., Manchester, Conn.
Cincinnati Gear Co., Cincinnati
Cincinnati Lathe & Tool Co., Cincinnati
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
Gear Specialties Inc., Chicago
Gleason Works, Rochester, N. Y.
Grant Gear Works, Inc., Boston
Hartford Special Machinery Co., Hartford, Conn.
Meisel Press Mfg. Co., Boston
Michigan Tool Co., Detroit
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia
Stahl Gear & Machine Co., Cleveland

GEARS, Master
Earle Gear & Mach. Co., Philadelphia
Fellows Gear Shaper Co., Springfield, Vt.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

GEARS, Non-Metallic
Adams Co., Dubuque, Iowa
Bakelite Corp., N. Y. C.
Bilgram Gear & Mach. Wks., Philadelphia
Braun Gear Corp., Brooklyn, N. Y.
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
Grant Gear Works Inc., Boston
Hartford Special Machinery Co., Hartford, Conn.
James Co., D. O., Chicago
Meisel Press Mfg. Co., Boston
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia
Stahl Gear & Machine Co., Cleveland
Taylor Machine Co., Cleveland
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

GOGGLES, Face Shields & Sweat Bands
American Optical Co., Southbridge, Mass.

GRAINS, Abrasive
Bay State Abrasive Prod. Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.
Sterling Grinding Wheel Div., Tiffin, O.

GRINDERS, Abrasive-Belt
Delta Mfg. Co., Milwaukee
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.

Even learners gage accurately to fractions of .0001" with COMTORPLUG!

Automatic features assure positive 2-point gaging accuracy with **COMTORPLUG**

Checks bores to fractions of .0001" for size, out-of-round, front or back taper, bell mouth, barrel shape, etc.

Sizes: ¼" to 7" dia. & larger

Comtorplug is a unique gage. While offering the extreme accuracy demanded by government and private inspectors on the closest ordnance and airplane parts, at the same time it is so simple and automatic that ordinary hands and machine operators also get split-tenth accuracy. This patented internal expanding gage is self-aligning and self-centering, giving positive 2-point gaging of ANY PART of a bore, reaching to the very bottom of blind holes, such as propeller stud holes. Because it shows ACTUAL SIZE to a fraction of .0001", it is much more effective than a limit gage, particularly in warning operators in time to change settings BEFORE work gets out of size.

Request Bulletin 27

The COMTOR Co.
68 Rumford Ave.
WALTHAM, MASS.

PLAIN CYLINDRICAL PLUG GAGES
new, made in plain tool steel or special non-expanding, high abrasion-resistant gage steel, A.G.D.S. or to print.

WORN GAGES SALVAGED
brought back to original size by Special Hard Chromium Plating. All work finished at 68° F. Good deliveries.

SPECHT ENGINEERING COMPANY
409 Atlantic Avenue Brooklyn, N. Y.

RANDALL & STICKNEY
Universal Gauge

for rigid inspection of a wide range of parts . . .

An almost unlimited use is offered by this instrument for inspecting duplicate parts in quantity or any small parts with flat surfaces or recesses.

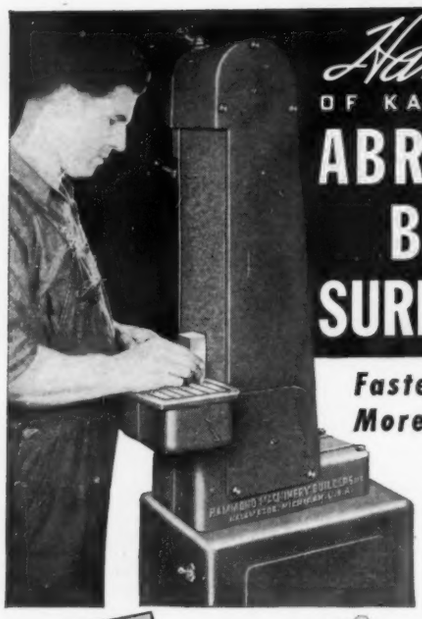
Use of standard blocks made possible by raising or lowering table increases capacity to take material up to 2" in height. Graduated to read to .001 inch; height 9¾"; weight 5 lbs., 1¼ oz.; depth from frame to spindle 1⅝".

Can be supplied with sliding head and table; also on a stand with throat 3" deep.

Full details on request

RANDALL & STICKNEY
Makers *Waltham, Mass.*

PRESSES
FEEDS
AUTOMATIC EQUIPMENT
THE V & O Press Co., INC.
HUDSON, N. Y.



Hammond OF KALAMAZOO

ABRASIVE BELT SURFACERS

Faster . . . More Economical

Speed and precision by hand operation on the "600" offers greater savings in fixture expense and set-up time. Universal in scope of materials handled, the "600" is a great production aid.

WRITE FOR BULLETIN GP-7

VISIT OUR BOOTH D-122 METAL SHOW CLEVELAND OCT. 12-16

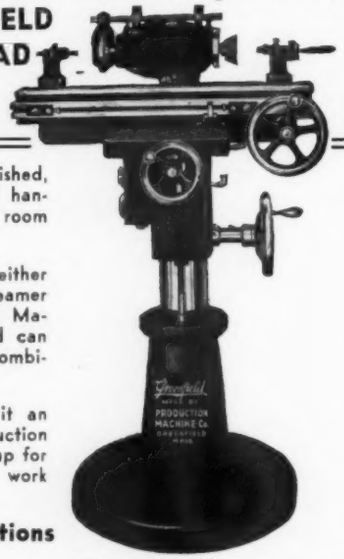
Model 400 Dri

Hammond Machinery Builders INC.

1618 DOUGLAS AVENUE • KALAMAZOO • MICHIGAN

EASTERN BRANCH: 71 WEST 23RD STREET, NEW YORK CITY

TOOL SHARPENING or TOOL ROOM GRINDING *handled accurately on the* No. 3 GREENFIELD MOTOR-IN-HEAD GRINDER



With the attachments furnished, this machine is capable of handling a wide variety of tool room or production work.

While ordinarily furnished either as a plain Cutter and Reamer Grinder or as a Universal Machine, the No. 3 Greenfield can be furnished in any other combination if desired.

Heavy construction makes it an ideal machine for production work. It can be quickly set up for accurate grinding of any work within its capacity.

Condensed Specifications

Swing over table—6¼"
Dist. between centers—21"
Length of Table Travel—15"
Cross feed—6"
Vertical feed—7"
Capacity Cutters on Centers—6¼" dia.
Capacity Cutters on Holder—14" dia.
Chuck Capacity—3¾"

WRITE FOR COMPLETE DETAILS

PRODUCTION MACHINE CO.

Also manufacturers of Drilling Machines and Hand and Automatic Polishing and Grinding Machines

GREENFIELD, MASS., U. S. A.

WHERE-TO-BUY DIRECTORY

Mattison Machine Works, Rockford, Ill.
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Walker-Turner Co., Inc., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

GRINDERS, Bench & Pedestal
Atlas Press Co., Kalamazoo, Mich.
Black & Decker Mfg. Co., Towson, Md.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Machinery & Engrg. Co., Chicago
Delta Mfg. Co., Milwaukee
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Hardinge Brothers, Inc., Elmira, N. Y.
Hobart Brothers, Troy, Ohio
Norton Co., Worcester, Mass.
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Queen City Machine Tool Co., Cincinnati
Schauer Machine Co., Cincinnati
Stow Mfg. Co., Binghamton, N. Y.
Union Twist Drill Co., Athol, Mass.
Vonnegut Moulder Corp., Indianapolis
Walker Co., O. S., Worcester, Mass.
Walker-Turner Co., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

GRINDERS, Cam
Landis Tool Co., Waynesboro, Pa.
Norton Co., Worcester, Mass.

GRINDERS, Carbide Tool
Blount Co., J. G., Everett, Mass.
Ex-Cell-O Corp., Detroit
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.

GRINDERS, Centerless
Cincinnati Grinders, Inc., Cincinnati
Heald Machine Co., Worcester, Mass.
Metal Carbides Corp., Youngstown, O.

GRINDERS, Chucking
Blanchard Machine Co., Cambridge, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Mach. Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDERS, Contour
Baker Bros., Inc., Toledo, Ohio
Blanchard Machine Co., Cambridge, Mass.
Thompson Grinder Co., Springfield, O.

GRINDERS, Cutter & Tool
Abrasive Mach. Tool Co., E. Providence, R. I.
Barber-Colman Co., Rockford, Ill.
Blount Co., J. G., Everett, Mass.
Boggis & Co., H. P., Cleveland
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Carboloy Co., Inc., Detroit
Cincinnati Milling Mach. Co., Cincinnati
Continental Machines, Inc., Minneapolis
Covel Mfg. Co., Benton Harbor, Mich.
Delta Mfg. Co., Milwaukee
Ex-Cell-O Corp., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
General Machinery Corp., Boston
Geometric Tool Co., New Haven, Conn.
Gorton Machine Co., Geo., Racine, Wis.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Heald Machine Co., Worcester, Mass.
Kearney & Trecker Co., Milwaukee
Landis Machine Co., Waynesboro, Pa.
Landis Tool Co., Waynesboro, Pa.
LeBlond Mach. Tool Co., R. K., Cincinnati
Lee & Son, K. O., Aberdeen, S. D.
National Acme Co., Cleveland
Norton Co., Worcester, Mass.
Oliver Instrument Co., Adrian, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Scherr Co., Inc., Geo., N. Y. C.
Sellers & Co., Inc., Wm., Philadelphia
Standard Tool Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Thompson Grinder Co., Springfield, O.
Union Twist Drill Co., Athol, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Cylindrical
Arter Grinding Mach. Co., Worcester, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Grinders, Inc., Cincinnati
Dumore Co., Racine, Wis.
Farrel-Birmingham Co., Ansonia, Conn.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., Bedford, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., Worcester, Mass.
Thompson Grinder Co., Springfield, O.

GRINDERS, Disk
Delta Mfg. Co., Milwaukee
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gardner Machine Co., Beloit, Wis.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Lempco Products, Inc., Bedford, O.
Porter Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Queen City Mach. Tool Co., Cincinnati
Walls Sales Corp., N. Y. C.

GRINDERS, Drill & Tap
Blake Co., Edward, Newton Center, Mass.
Covel Mfg. Co., Benton Harbor, Mich.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Oliver Instrument Co., Adrian, Mich.
Sellers & Co., Wm., Philadelphia
Union Twist Drill Co., Athol, Mass.

GRINDERS, Face or Ring Wheel
Abrasive Mach. Tool Co., E. Providence, R. I.
Blanchard Machine Co., Cambridge, Mass.
Blount Co., J. G., Everett, Mass.
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Bryant Chucking Grinder Co., Springfield, Vt.
Cincinnati Bickford Tool Co., Oakley, Cincinnati
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Lempco Products, Inc., Bedford, O.

GRINDERS, Gear
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gear Grinding Machine Co., Detroit
Gleason Works, Rochester, N. Y.
Lees-Bradner Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

GRINDERS, Internal
Arter Grinding Mach. Co., Worcester, Mass.
Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Hartford Special Machinery Co., Hartford, Conn.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Lempco Products, Inc., Bedford, O.
Rivett Lathe & Grinder, Inc., Boston

Simplex-M Abrasive Band Grinder

This grinder speeds production and cuts cost—abolishes expensive hand emerying or filing operations. The use of this modern machine assures straight grain finishes with sharp edges. *Write for new catalog on this and other sizes.*

WALLS SALES CORP.

96 Warren St. • New York

WHERE-TO-BUY DIRECTORY

Sav-Way Tool & Mach. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Thompson Grinder Co., Springfield, O.
Van Norman Machine Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Jig
Moore Spec. Tool Co., Bridgeport, Conn.

GRINDERS, Knife & Shear-Blade
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Atkins & Co., E. C., Indianapolis
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Hill Acme Co., Cleveland
Mattison Machine Works, Rockford, Ill.

GRINDERS, Lathe-Attachment (See **ATTACHMENTS, Lathe**)

GRINDERS, Portable Electric (See also **TOOLS, Portable Electric**)
Black & Decker Mfg. Co., Towson, Md.
Chicago Wheel & Mfg. Co., Chicago
Dremel Mfg. Co., Racine, Wis.
Dumore Co., Racine Wis.
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.
Haskins Co., B. G., Chicago
Porter-Cable Mach. Co., Syracuse, N. Y.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rotor Tool Co., Cleveland

GRINDERS, Spline
Fitchburg Grinding Machine Corp., Fitchburg, Mass.

GRINDERS, Surface
Abrasive Mach. Tool Co., E. Providence, R. I.
Arter Grinding Mach. Co., Worcester, Mass.
Atlantic Machinery Co., N. Y. C.
Blanchard Mach. Co., Cambridge, Mass.
Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis
Covel Mfg. Co., Benton Harbor, Mich.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Gardner Machine Co., Beloit, Wis.
Hammond Machy. Builders, Inc., Kalamazoo, Mich.
Heald Machine Co., Worcester, Mass.
Hill Acme Co., Cleveland
Landis Tool Co., Waynesboro, Pa.
Leach Machinery Co., H., Providence
Mattison Machine Works, Rockford, Ill.
Murchey Machine & Tool Co., Detroit
Norton Co., Worcester, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Thompson Grinder Co., Springfield, O.
Van Norman Machine Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester, Mass.

GRINDERS, Swing-Frame
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Hammond Machinery Builders, Inc., Kalamazoo, Mich.
Jefferson Machine Tool Co., Cincinnati
Vonnegut Moulder Corp., Indianapolis

GRINDERS, Thread
Ex-Cello-O Corp., Detroit
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.

GRINDERS, Universal
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati
Covel Mfg. Co., Benton Harbor, Mich.
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Gallmeyer & Livingston Co., Grand Rapids, Mich.
Landis Tool Co., Waynesboro, Pa.
LeBlond Mach. Tool Co., R. K., Cincinnati
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Boston
Thompson Grinder Co., Springfield, O.

GRINDING, Centerless (See **CONTRACT WORK**)

GROOVERS, Oil
Hanson-Whitney Mach. Co., Hartford, Conn.
National Machine Tool Co., Cincinnati

GUARDS & SAFETY APPLIANCES, Machinery
Junkin Safety Appliance Co., Louisville, Ken.
Littleford Bros., Cincinnati
Schrader's Son, A., Brooklyn, N. Y.

HACK SAW BLADE GRINDING FIXTURE (See **Saw Blade Grinding Fixtures**)

HAMMERS, Drop
Farrel-Birmingham Co., Ansonia, Conn.
Niagara Mach. & Tool Wks., Buffalo, N. Y.

HAMMERS, Portable Electric
Black & Decker Mfg. Co., Towson, Md.
Cleveland Pneu. Tool Co., Cleveland

HAMMERS, Power
General Machinery Corp., Hamilton, O.
Murray Mfg. Co., D. J., Wausau, Wis.
Sellers & Co., Wm., Philadelphia

HAMMERS, Softfaced
Greene, Tweed & Co., N. Y. C.
Johnson Tool Co., Inc., E. Providence, R. I.

HANDLES, Crank & Machine
Machine Products Corp., Detroit
Williams & Co., J. H., Buffalo, N. Y.

HANDLES, File
Disston & Sons, Inc., Henry, Philadelphia
Nicholson File Co., Providence, R. I.
Parker-Kalon Corp., N. Y. C.

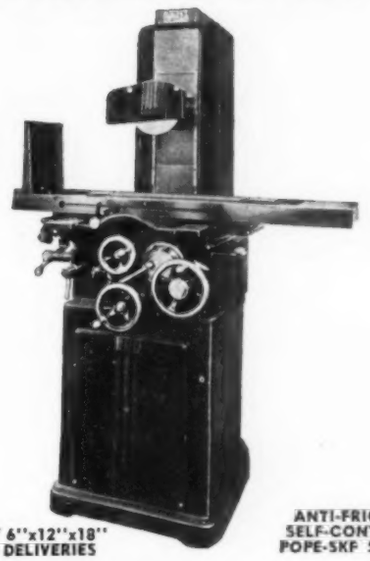
HANDLES, Gage
Federal Tool Co., Chicago

HANGERS, Shaft
Allis-Chalmers Mfg. Co., Milwaukee
American Pulley Co., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Fafnir Bearing Co., New Britain, Conn.
Hill Acme Co., Cleveland
Morse Chain Co., Ithaca, N. Y.
SKF Industries, Inc., Philadelphia

ATLANTIC

No. 2 Automatic Precision Type

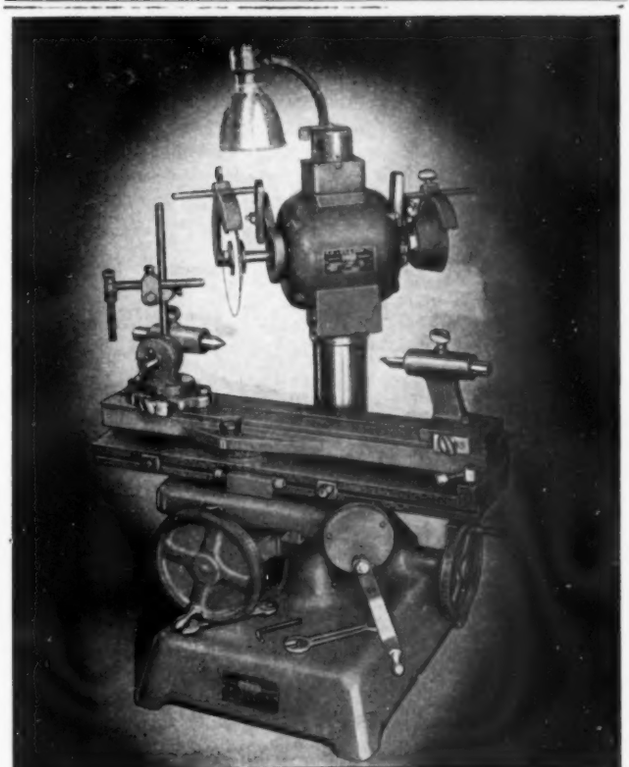
SURFACE GRINDER



CAPACITY 6"x12"x18"
PROMPT DELIVERIES

ANTI-FRICTION
SELF-CONTAINED
POPE-SKF SPINDLE

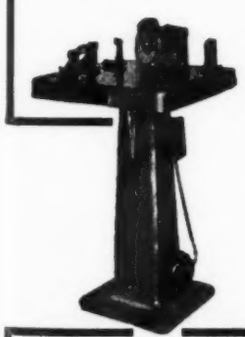
ATLANTIC MACHINERY CORP.
149 Broadway New York, N. Y.



The New Model A600 Tool and Cutter Grinder

Our Bulletin TCG42—AM will give you all important details

K. O. LEE COMPANY
Aberdeen, South Dakota ★ U. S. A.



FASTER, MORE ACCURATE CUTTER GRINDING ASSURED with the "BARNES"

The Barnes Precision Cutter Grinder will grind formed cutters faster and preserve form absolutely. Cutter life is extended five to eight times over ordinary methods.

Utility and speed of the "Barnes" extends to the grinding of all types of cutters regardless of profile without changing existing cutter equipment. Form relieved cutters, sharpened on this machine become profile cutters. No high degree of skill is required to grind even the most complicated or irregular formed cutter.

Send for Descriptive Circular

GENERAL MACHINERY CORP.
140 Federal St. Boston, Mass.

Eliminates Hand Lapping

CASE HISTORY
NUMBER 6

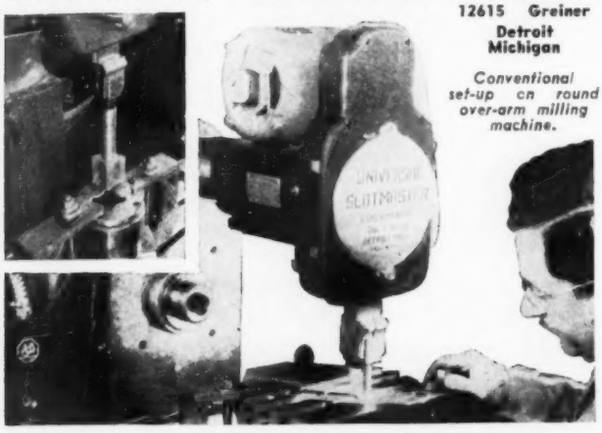
Lapping of intricate H.S.S. compression dies, with a Universal Slotmaster requires a man's time only while setting up the job. . . . The operation is started by lowering the lapping arbor to the mouth of the die opening and then setting the down-stroke of the slotter so that it will completely compress the spring, which is mounted between a shoulder on the shank of the lapping arbor and the tool holder. The spring then gradually relaxes and the lapping arbor works its way into the opening, as a result of spring pressure and the stroking of the slotter. When the spring is completely relaxed — the down-stroke of the slotter is again set up to completely compress the spring and the operation is repeated until the full length of the opening in the die has been lapped.

Thumbnail illustrates set-up

SLOTMASTER can be used on milling machines and provides double duty facilities at a minimum cost. It requires but little time to change-over from one head to the other. . . . The stroke of the ram is adjustable from 0 to 4" . . . the speeds range from 50 to 250 s.p.m. . . . The tool holder of the clapper box type, can be turned in any position. . . . All of the working parts are of tool steel heat treated and ground to close tolerances. . . . SLOTMASTER comes complete with pulleys, motor, belt and mounting adaptable to round over-arm or flat-on-round overarm milling machines.

Send for 4-page catalog and give the specifications of the milling machines that you wish to equip. Immediate deliveries on high priorities.

EXPERIMENTAL TOOL & DIE COMPANY
12615 Greiner
Detroit
Michigan



Conventional set-up on round over-arm milling machine.

INVESTIGATE

. . . Shore's Improved Portable Scleroscope Testing Set, Model C-2, Speedy, non-destructive. The World's Standard Hardness Tester since 1907, is still effective and popular.

Write for Circular!

THE SHORE INSTRUMENT & MANUFACTURING CO., INC.
9025 Van Wyck Ave., Jamaica, N. Y.
Jamaica 6-4090

LATHE TOOLS THAT LAST LONGER

Because holders are made of a chrome nickel drop forging, pratically unbreakable in shop practice.

THE READY TOOL CO.
IRANISTAN & R.R. AVES. BRIDGEPORT, CONN.

WHERE-TO-BUY DIRECTORY

HARDENING MACHINES, Flame
Air Reduction, N. Y. C.
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.

HARDWARE, Industrial
Masbeck Hardware Co., Inc., N. Y. C.

HEADERS, Rivet
Ajax Mfg. Co., Cleveland
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Hill Acme Co., Cleveland
Tomkins-Johnson Co., Jackson, Mich.

HEADS, Boring
Bullard Co., Bridgeport, Conn.
Carboloy Co., Inc., Detroit
Criterion Mach. Wks., Beverly Hills, Cal.
Elmes Engrg. Wks., Chas. F., Chicago
Fray Machine Tool Co., Glendale, Calif.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Lovejoy Tool Co., Inc., Springfield, Vt.
Rickert-Shafer Co., Erie, Pa.
Scully-Jones & Co., Chicago
Taft-Peirce Mfg. Co., Woonsocket, R. I.

HEADS, Dividing
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati
Hartford Special Machry. Co., Hartford, Conn.
Jefferson Mach. Tool Co., Cincinnati
L-W Chuck Co., Toledo, O.
Scherr Co., Geo., N. Y. C.

HEADS, Drilling
Atlas Press Co., Kalamazoo, Mich.
Baker Bros., Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Bradford Machine Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Errington Mech. Lab., Stapleton, N. Y.
Etteo Tool Co., Brooklyn, N. Y.
Ex-Cell-O Corp., Detroit
Foote-Burt Co., Cleveland
Greenlee Bros. & Co., Rockford, Ill.
Kingsbury Mach. Tool Co., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
Snyder Tool & Engrg. Co., Detroit

HEADS, Grinding
Ex-Cell-O Corp., Detroit
Fitchburg Grinding Machine Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Machine Co., Waynesboro, Pa.

HEADS, Milling
Cincinnati Milling Mach. Co., Cincinnati
Kempsmith Machine Co., Milwaukee

HEADS, Slotting
Experimental Tool & Die Wks., Detroit

HEADS, Tapping
Atlas Press Co., Kalamazoo, Mich.
Baker Bros., Inc., Toledo, O.
Barnes Co., W. F. & John, Rockford, Ill.
Bradford Mach. Tool Co., Cincinnati
Cross Gear & Machine Co., Detroit
Errington Mech. Lab., Stapleton, N. Y.
Etteo Tool Co., Brooklyn, N. Y.
Foote-Burt Co., Cleveland
Greenlee Bros. & Co., Rockford, Ill.
Kingsbury Mach. Tool Co., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
National Auto. Tool Co., Richmond, Ind.

HEATERS, Rivet
American Gas Furn. Co., Elizabeth, N. J.
General Electric Co., Schenectady, N. Y.

HEATERS, Unit
Buffalo Forge Co., Buffalo, N. Y.
Murray Mfg. Co., D. J., Wausau, Wis.
Surface Combustion Corp., Toledo, O.
Wiedemann Machine Co., Philadelphia

HELMETS & SHIELDS, Welding
Air Reduction, N. Y. C.
American Optical Co., Southbridge, Mass.
Harnischfeger Corp., Milwaukee
Hobart Bros. Co.,, Troy, O.
Lincoln Electric Co., Cleveland

HOBBERS, Gear
Adams Co., Dubuque, Iowa
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Hobbing Machy. Co., Cleveland
Lees-Bradner Co., Cleveland
Scherr Co., Geo., N. Y. C.

HOBS
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hanson-Whitney Mach. Co., Hartford, Conn.
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Union Twist Drill Co., Athol, Mass.

HOISTS, Chain
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Ford Chain Block Div., Am. Chain & Cable Co., Philadelphia
Wright Mfg. Div. of Am. Chain Cable Co., York, Pa.

HOISTS, Electric
Allis-Chalmers Mfg. Co., Milwaukee
American Engrg. Co., Philadelphia
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Harnischfeger Corp., Milwaukee
Philadelphia Gear Works, Philadelphia
Wright Mfg. Div., Amer. Chain & Cable Co., York, Pa.

HOISTS, Pneumatic
Curtis Pneu. Machy. Co., St. Louis
Tomkins-Johnson Co., Jackson, Mich.

HOLDERS, Tool
Armstrong Bros. Tool Co., Chicago
Auto Ordnance Corp., Bridgeport, Conn.
Cincinnati Lathe & Tool Co., Cincinnati
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Errington Mech. Lab., Stapleton, N. Y.
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.

DAVIS KEYSEATER

This low cost machine will handle any keyseating job in the shop up to 1 ¼ in.

Write for illustrated bulletin

DAVIS KEYSEATER CO., 403 Exchange St., Rochester, N. Y.

BARNESDRIL

Honers . . . Drillers

Write Today for Catalog A.

Barnes Drill Co. 830 CHESTNUT ST. ROCKFORD ILLINOIS, U.S.A.

WHERE-TO-BUY DIRECTORY

Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Sturdimatic Tool Co., Detroit
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

HONES & HONING MACHINES
Automotive Maintenance Machy. Co., No. Chicago, Ill.
Barnes Drill Co., Rockford, Ill.
Barnes Co., W. F., & John, Rockford, Ill.
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y.
Micromatic Hone Corp., Detroit
Norton Co., Worcester, Mass.
Sunnen Products Co., St. Louis, Mo.

HOOKS, Hoist
Kropp Forge Co., Chicago
Williams & Co., J. H., Buffalo, N. Y.

HOSE, Flexible Metal
Chicago Metal Hose Corp., Maywood, Ill.

HOSE, Rubber
Dayton Rubber Mfg. Co., Dayton, O.
Gates Rubber Co., Denver, Colo.

HYDRAULIC EQUIPMENT
Denison Engineering Co., Columbus, Ohio
Ex-Cell-O Corp., Detroit
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lempco Products, Inc., Bedford, O.
Vickers, Inc., Detroit
Watson-Stillman Co., Roselle, N. J.

INDEXING FIXTURES (See FIXTURES, Indexing)

INDICATORS, Dial (See GAGES, Dial)

INDICATORS, Speed
Brown & Sharpe Mfg. Co., Providence, R. I.
Brown Instrument Co., Philadelphia
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.

INDICATORS, Temperature
Brown Instrument Co., Philadelphia

INSTRUMENTS, Hardness-Measuring
Shore Inst. & Mfg. Co., Jamaica, N. Y.
Wilson Mechanical Inst. Co., N. Y. C.

INSTRUMENTS, Optical Inspection
Jones & Lamson Mach. Co., Springfield, Vt.
Vard, Inc., Pasadena, Calif.

JACKS, Machinist's
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

JIG-BORING MACHINES
Baker Bros., Inc., Toledo, O.
Cincinnati Bickford Tool Co., Cincinnati
Fosdick Machine Tool Co., Cincinnati
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Knight Machinery Co., W. B., St. Louis
Linley Brothers Co., Bridgeport, Conn.
Machinery Mfg. Co., Los Angeles
Moore Special Tool Co., Inc., Bridgeport, Conn.
Pratt & Whitney Co., Div. Niles-Bement-Pond Co., Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.

JIGS & FIXTURES (See CONTRACT WORK)

JOINTS, Universal
Baush Mach. Tool Co., Springfield, Mass.
Mollart Engrg. Co., Ltd., Surrey, Eng.
National Auto. Tool Co., Richmond, Ind.
Philadelphia Gear Works, Philadelphia

KEYSEATERS
American Broach & Mach. Co., Ann Arbor, Mich.
Baker Bros., Inc., Toledo, O.
Consolidated Machine Tool Corp., Rochester, N. Y.
Davis Keyseater Co., Rochester, N. Y.
General Machinery Corp., Hamilton, O.
Lapointe Mach. Tool Co., Hudson, Mass.
Mitts & Merrill, Saginaw, Mich.
National Machine Tool Co., Cincinnati
Reed-Prentice Corp., Worcester, Mass.

KNIVES, Shear
Atkins & Co., E. C., Indianapolis
Cincinnati Shaper Co., Cincinnati
Cleveland Punch & Shear Works Co., Cleveland
Colonial Broach Co., Detroit
Disston & Sons, Inc., Henry, Philadelphia
Haynes Stellite Co., N. Y. C.
Michigan Tool Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.

KNURLS & KNURL HOLDERS
American Swiss File & Tool Co., Elizabeth, N. J.
Armstrong Bros. Tool Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

LABELS
Ever Ready Label Corp., N. Y. C.

LAPPERS, Centerless
Cincinnati Grinders, Inc., Cincinnati
Ex-Cell-O Corp Detroit
Production Mach. Co., Greenfield, Mass.
Ultra-Lap Mach. Co., Detroit

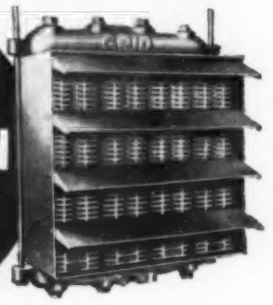
LAPPERS, Cylindrical & Flat
Automotive Maintenance Machy. Co., No. Chicago, Ill.
Ex-Cell-O Corp., Detroit
Moline Tool Co., Moline, Ill.
Norton Co., Worcester, Mass.
Sellers & Co., Inc., Wm., Philadelphia
Ultra-Lap Mach. Co., Detroit

LAPPERS, Gear
American Tool Works Co., Cincinnati
Colonial Broach Co., Detroit
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
Ultra-Lap Mach. Co., Detroit

LAPS, Toolmaker's
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Producto Mach. Co., Bridgeport, Conn.
Starrett, L. S., & Co., Athol, Mass.
Ultra-Lap Mach. Co., Detroit

IT'S STILL A *different* UNIT HEATER

NOW made with CAST IRON Heating Sections



Cast iron takes the place of aluminum for the heating sections, to cooperate with the war effort in using substitute materials—but it's still the ultimate in unit heater quality.

THE new Grid is engineered along the same lines as the Grid Unit which had aluminum heating sections—dependable, long life unit. A special design. Patent applied for. No corrosion—no leaks or breakdowns . . . In this new Grid Unit there is only one type metal in contact with steam or hot water. There is nothing to cause electrolysis that produces corrosion. Engineered and constructed to withstand up to 250 lb. steam pressure. Ask for details now.

D. J. MURRAY MFG. CO., Wausau, Wisconsin
Offices in Principal Cities

GRID UNIT HEATER

FLATNESS and SMOOTHNESS of Production Parts

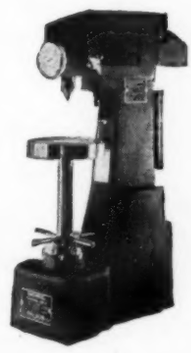
The Ultra-Lap machine will finish your parts to a flatness of one light band or less . . . to a smoothness as low as one micro-inch R.M.S., any metal or material. Much faster, more uniform than hand method. Machine designed for you or we shall be pleased to lap your parts on a job basis. Ultra-Lap machines and service used by aircraft and many other war-time industries.

Ultra-Lap MACHINE COMPANY
207 McDOUGALL AVE. • DETROIT, MICH.

"ROCKWELL" HARDNESS TESTER

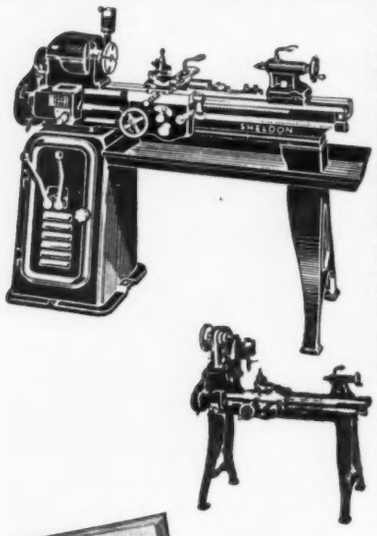
The word "ROCKWELL" is our registered trade mark for testers that we make in many sizes. We have made them for twenty-one years.

We make these in many types, so please give particulars of intended use.



WILSON
MECHANICAL INSTRUMENT CO. INC.
743 E. 143 St., N. Y.

SHELDON Back Geared Screw Cutting PRECISION LATHES

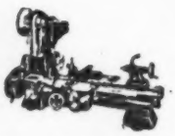


FOR THE TOOL ROOM

The finest 10", 11" and 12" lathes ever built in the moderate price field. Large special analysis steel spindles GROUND ALL OVER, with extra collet capacity. Hand-scraped Bronze, Ultra-Precision Ball or Super-Precision Roller spindle bearings, (the finest bearing obtainable). Heavy braced, semi-steel beds with hand scraped ways (2 V-ways and 2 flat ways). These lathes come with a choice of aprons, gear boxes, and drives including the anti-friction, 4-speed, V-belt Lever-operated pedestal base motor drive illustrated. Telescopic Taper Attachment and other accessories available.

FOR PRODUCTION

Lathes with lever operated collets, lever cross slides and tailstocks. Ideal for second operation work—sturdily built precision tools.



FOR MACHINE SHOP

and maintenance department lathes, with a wide choice of attachments, accessories and drives.

Write for Catalog

Just out "The Care and Operation of a Lathe" to help apprentice training. 50¢ list price, discounts for quantity purchases.

SHELDON MACHINE CO., INC.
4234 N. Knox Ave. Chicago, U. S. A.

Output Goes UP
Costs Go DOWN
with

NICHOLSON *EXPANDING* MANDRELS

Economy tools . . . for holding work while being machined between centers on lathes, grinders, millers, shapers, etc. Hardened tool steel, accurately ground. Sold singly or in sets. Prompt delivery. Write for bulletin.

W. H. NICHOLSON & CO.
114 OREGON ST., WILKES-BARRE, PA.

Other Products: Arbor Presses—Control Valves—Steam Traps—Floats
Flexible Couplings—Compression Shaft Couplings

WHERE-TO-BUY DIRECTORY

LATHE PANS
Littleford Bros., Cincinnati

LATHES, Automatic & Semi-Automatic
Bullard Co., Bridgeport, Conn.
Cleveland Auto. Mach. Co., Cleveland
Gisholt Machine Co., Madison, Wis.
Goss & deLeeuw Machine Co., New Britain, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Kingsbury Mach. Tool Corp., Keene, N. H.
LeBlond Mach. Tool Co., R. K., Cincinnati
Lipe-Rollway Corp., Syracuse, N. Y.
Lodge & Shipley Mach. Tool Co., Cincinnati
Monarch Machine Tool Co., Sidney, O.
National Acme Co., Cleveland
New Britain-Gridley Mach. Div., New Britain, Conn.
Porter Cable Mach. Co., Syracuse, N. Y.
Potter & Johnston Machine Co., Pawtucket, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Rockford Mach. Tool Co., Rockford, Ill.
Seneca Falls Mach. Co., Seneca Falls, N. Y.
Smallpiece, Ltd., Beverly, Mass.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Warner & Swasey Co., Cleveland
Wickman Corp., Detroit

LATHES, Bench
Ames Co., B. C., Waltham, Mass.
Atlas Press Co., Kalamazoo, Mich.
Blount Co., J. G., Everett, Mass.
Bradford Machine Tool Co., Cincinnati
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
LeBlond Mach. Tool Co., R. K., Cincinnati
Logan Engineering Co., Chicago
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Boston
Schauer Machine Co., Cincinnati
Seneca Falls Mach. Co., Seneca Falls, N. Y.
Sheldon Machine Co., Chicago
Sidney Machine Tool Co., Sidney, O.
South Bend Lathe Works, S. Bend, Ind.
Stark Tool Co., Waltham, Mass.
Walker-Turner Co., Inc., Plainfield, N. J.
Warner & Swasey Co., Cleveland

LATHES, Crankshaft
American Tool Works, Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
LeBlond Mach. Tool Co., R. K., Cincinnati
Lodge & Shipley Machine Tool Co., Cincinnati
Potter & Johnston Machine Co., Pawtucket, R. I.
Sundstrand Mach. Tool Co., Rockford, Ill.
Sunnen Products Co., St. Louis

LATHES, Double Engine
Jones & Lamson Machine Co., Springfield, Vt.

LATHES, Engine & Toolroom
American Tool Works Co., Cincinnati
Ames Co., B. C., Waltham, Mass.
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., Los Angeles
Bradford Machine Tool Co., Cincinnati
Bryant Machinery & Engrg. Co., Chicago
Cincinnati Gilbert Machine Tool Co., Cincinnati
Cincinnati Lathe & Tool Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
General Machinery Corp., Hamilton, O.
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Hendey Machine Co., Torrington, Conn.
LeBlond Mach. Tool Co., R. K., Cincinnati
Lodge & Shipley Mach. Tool Co., Cincinnati
Monarch Machine Tool Co., Sidney, O.
Morris Machine Tool Co., Cincinnati
Porter McLeod Mach. Tool Co., Hatfield, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Reed-Prentice Co., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Boston
Rockford Mach. Tool Co., Rockford, Ill.
Seneca Falls Mach. Co., Seneca Falls, N. Y.
Sheldon Machine Co., Chicago
Sidney Machine Tool Co., Sidney, O.
Simmons Mach. Tool Corp., Albany, N. Y.
South Bend Lathe Works, S. Bend, Ind.

LATHES, Gun
American Tool Works Co., Cincinnati

LATHES, Shell
American Tool Works Co., Cincinnati
Bullard Co., Bridgeport, Conn.
Cincinnati Lathe & Tool Co., Cincinnati
Cleveland Hobbing Machy. Co., Cleveland
Coulter Mach. Co., Jas., Bridgeport, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Lipe-Rollway Corp., Syracuse, N. Y.
Lodge & Shipley Mach. Tool Co., Cincinnati
Morey Machinery Co., Inc., N. Y. C.
Seneca Falls Mach. Co., Seneca Falls, N. Y.
Smallpeice, Ltd., Beverly, Mass.
Sundstrand Mach. Tool Co., Rockford, Ill.

LATHES, Turret
Acme Machine Tool Co., Cincinnati
Bardons & Oliver, Inc., Cleveland
Bullard Co., Bridgeport, Conn.
Cincinnati Lathe & Tool Co., Cincinnati
Diehl Mach. Wks., G. M., Wabash, Ind.
General Machinery Corp., Hamilton, O.
Gisholt Machine Co., Madison, Wis.
Goss & deLeeuw Machine Co., New Britain, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hardinge Brothers, Inc., Elmira, N. Y.
Jones & Lamson Mach. Co., Springfield, Vt.
Monarch Machine Tool Co., Sidney, O.
Morey Machinery Co., Inc., N. Y. C.
National Acme Co., Cleveland
Potter & Johnston Machine Co., Pawtucket, R. I.
Simmons Mach. Tool Corp., Albany, N. Y.
South Bend Lathe Wks, South Bend, Ind.
Springfield Mach Tool Co., Springfield, O.
Warner & Swasey Co., Cleveland

LEVELS, Precision
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Starrett Co., L. S., Athol, Mass.
Universal Boring Mach. Co., Hudson, Mass.

LATHE PANS

"Speed Up" for Victory. Let Littleford make your *Lathe Pans*, Gear Guards, Splash Guards, or Machine Bases. Any size or shape can be fabricated in our modern plant. Send blueprints for prices and delivery dates.

LITTLEFORD
LITTLEFORD BROS., INC.
434 E. Pearl St. Cincinnati, Ohio

WHERE-TO-BUY DIRECTORY

LIGHTING EQUIPMENT, Industrial
Fleurolier Mfgrs., Cleveland
General Elec. Co., Nela Park, Cleveland
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., Cleveland

LOCK NUTS
Bethlehem Steel Co., Bethlehem, Pa.
Elastic Stop Nut Corp., Elizabeth, N. J.
Fafnir Bearing Co., New Britain, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

LUBRICANTS
Cities Service Co., N. Y. C.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
Magnus Chem. Co., Garwood, N. J.
Oakite Products, Inc., N. Y. C.
Shell Oil Corp., N. Y. C.
Sinclair Refining Co., N. Y. C.
Socony-Vacuum Oil Co., N. Y. C.
Standard Oil Co. of Ind., Chicago
Stuart Oil Co., D. A., Chicago
Sun Oil Co., Philadelphia
Swan-Finch Oil Corp., N. Y. C.
Texas Co., N. Y. C.
Tidewater Oil Co., N. Y. C.

LUBRICATING SYSTEMS
American Cable Div., Am. Chain & Cable Co., Bridgeport, Conn.
De Laval Separator Co., N. Y. C.
Rivett Lathe & Grinder, Inc., Boston

MACHINE BASES
Clearing Machine Corp., Chicago
Littleford Bros., Cincinnati

MAGNETS, Lifting
General Electric Co., Schenectady, N. Y.

MALLETS (See **TOOLS, Hand**)

MANDRELS, Air Operated
Nicholson & Co., W. H., Wilkes-Barre, Pa.

MANDRELS, Expanding
Cleveland Twist Drill Co., Cleveland
Cushman Chuck Co., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Kearney & Trecker Corp., Milwaukee
Morse Twist Drill & Machine Co., New Bedford, Mass.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Producto Machine Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Tomkins-Johnson Co., Jackson, Mich.

MANDRELS, Solid (See **ARBORS & MANDRELS**)

MARKING MACHINES
Acromark Co., Elizabeth, N. J.
Gorton Machine Co., Geo., Racine, Wis.
Mathews & Co., James H., Pittsburgh
Moore Mfg. Co., Wm., Chicago
Noble & Westbrook Mfg. Co., East Hartford, Conn.
Numberall Stamp & Tool Co., Huguenot Park, N. Y.
Preis Engraving Mach. Co., H. P., Newark, N. J.

MASKS (See **RESPIRATORS**)

METAL-CLEANING EQUIPMENT
Barrett Co., Leon J., Worcester, Mass.
Bullard Co., Bridgeport, Conn.
Detroit Rex Products Co., Detroit
Hobart Bros. Co., Troy, O.
Stow Mfg. Co., Inc., Binghamton, N. Y.

METALS, Bearing
Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., New Castle, Pa.
National Bearing Metals Corp., St. Louis
Ryerson & Son, Jos. T., Chicago
Westinghouse Electric & Mfg. Co., E. Pittsburgh

MICROMETERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Central Tool Co., Auburn, R. I.
Davis & Thompson Co., Milwaukee
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Randall & Stickney, Waltham, Mass.
Scherr Co., Inc., George, N. Y. C.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

MICROSCOPES
Scherr Co., Geo., N. Y. C.

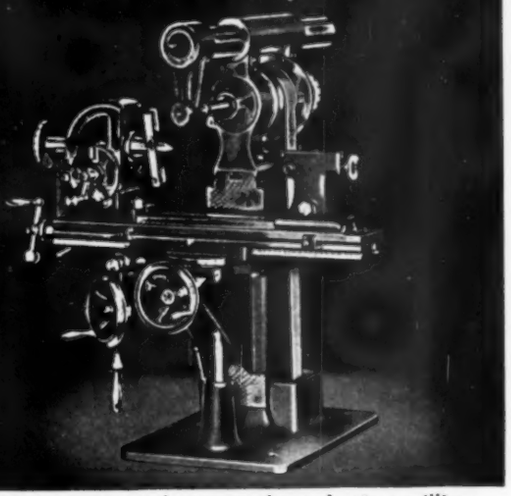
MILLERS, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Fitchburg Engrg. Corp., Fitchburg, Mass.
Kearney & Trecker Corp., Milwaukee
Kent-Owens Machine Co., Toledo, O.
Producto Machine Co., Bridgeport, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.

MILLERS, Bench
Ames Co., B. C., Waltham, Mass.
Atlas Press Co., Kalamazoo, Mich.
Burke Machine Tool Co., Conneaut, O.
Granite State Mach. Co., Inc., Manchester, N. H.
Hardinge Brothers, Inc., Elmira, N. Y.
Jefferson Mach. Tool Co., Cincinnati,
Linley Bros. Co., Bridgeport, Conn.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Stark Tool Co., Waltham, Mass.

MILLERS, Duplex
Cincinnati Milling Mach. Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., Milwaukee
Fitchburg Engrg. Corp., Fitchburg, Mass.
General Machinery Corp., Hamilton O.
Kearney & Trecker Corp., Milwaukee
Producto Machine Co., Bridgeport, Conn.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Mach. Tool Co., Springfield, Mass.

MILLERS, Hand
Atlantic Machinery Co., N. Y. C.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Brothers, Inc., Elmira, N. Y.
Jefferson Mach. Tool Co., Cincinnati
Kent-Owens Machine Co., Toledo, O.
Lucas & Sons, Inc., J. L., Bridgeport, Conn.
Nichols & Sons, W. H., Waltham, Mass.
Producto Machine Co., Bridgeport, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Mach. Tool. Co., Springfield, Mass.

AMEs Precision
BENCH MILLING MACHINE



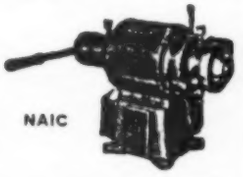
For most accurate toolroom and production milling. Large in size and capacity. Cutter head and indexing head take same 1" capacity collet. Separate headstock for vertical milling. Motor and jackshaft drive.

B. C. AMES CO., WALTHAM, MASS.

SCHAUER SPEED LATHES
. . . *Speed Production*

VAIE

Performs *faster* finishing operations . . . relieves more expensive machinery of this work.
"The originators of today's Speed Lathes"



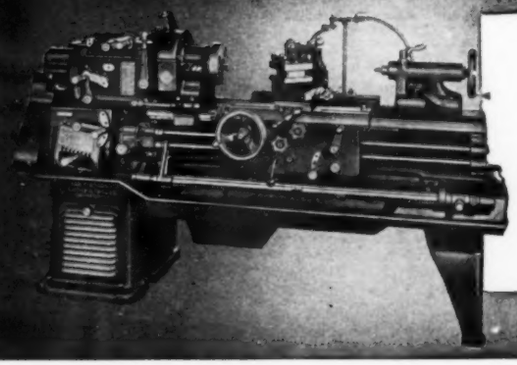
NAIC

With hand and foot operated mechanism . . . completely automatic . . . air operated . . . variable spindle speeds . . . vacuum holding fixtures.

Write for Catalog #420

SCHAUER MACHINE COMPANY
2067 Reading Road Cincinnati, Ohio

CINCINNATI LATHES



CINCINNATI LATHES
Accurate in Every Detail

Gears—precision cut, tempered and ground . . . Spindle—mounted on Roller Bearings to resist any combination of thrusts . . . Bed—extra heavy in construction . . . Ways and carriage hand scraped to a precision bearing. These features of Cincinnati Lathes add up to accuracy in every detail that insures precision results on every job. Write for complete specifications on 14" to 30" sizes to produce your work always most economically.

THE CINCINNATI LATHE & TOOL CO.
Marburg Road, Oakley SPECIALISTS SINCE 1906 Cincinnati, Ohio

NO. 1 HEAVY DUTY GEARED HEAD MILLER

Available with Longitudinal Power Feed or Hand Feed to Table

Table: 6"x24"
Capacity 5½"x8½"x18"

Geared Spindle Speeds — 6 forward, 6 reverse. Optional spindle speed ranges available:
150- 675 R.P.M.
200- 900 R.P.M.
350-1350 R.P.M.

Anti-friction speed and spindle assemblies.

Built in coolant pump and piping. Motor in base.

PROMPT DELIVERIES

ATLANTIC MACHINERY CORP.
149 Broadway, New York, N. Y.

CINCINNATI
OPEN SIDE HYPRO PLANERS

Selective magnetic dial feeds (Patented) and power rapid traverse to all heads—all steel herringbone balanced gear drive—massive pyramid type column are productive of ease of control—smooth flow of power and sustained rigidity. Points that spell continued accuracy and lower costs on this type of planer work.

Cincinnati Planer also builds Boring Mills and Planer Type Millers

The CINCINNATI PLANER Co.
CINCINNATI OHIO

WHERE-TO-BUY DIRECTORY

MILLERS, Plain & Universal
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati
Douglas Machinery Co., Inc., N. Y. C.
Fray Mach. Tool Co., Glendale, Calif.
Gorton Machine Co., Geo., Racine, Wis.
Granite State Mach. Co., Inc., Manchester, N. H.
Hardinge Brothers, Inc., Elmira, N. Y.
Jefferson Mach. Tool Co., Cincinnati
Kearney & Trecker Corp., Milwaukee
Kempsmith Machine Co., Milwaukee
Kent-Owens Machine Co., Toledo, O.
Lucas & Son, Inc., J. L., Bridgeport, Conn.
Knight Machinery Co., W. B., St. Louis
Machinery Mfg. Co., Chicago
Nichols & Sons, W. H., Waltham, Mass.
Ohio Machine Tool Co., Kenton, O.
Producto Machine Co., Bridgeport, Conn.
Sidney Machine Tool Co., Sidney, O.
Van Norman Machine Tool Co., Springfield, Mass.

MILLERS, Planer Type
Cincinnati Planer Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Fitchburg Engrg. Corp., Fitchburg, Mass.
General Machinery Corp., Hamilton, O.
Gidding & Lewis Mach. Tool Co., Fond du Lac, Wis.
Kearney & Trecker Corp., Milwaukee
Sellers & Co., Inc., Wm., Philadelphia

MILLERS, Planetary
Plan-O-Mill Corp., Royal Oak, Mich.

MILLERS, Profile
Cincinnati Milling Mach. Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Gorton Machine Co., Geo., Racine, Wis.
Knight Machinery Co., W. B., St. Louis
Morey Machinery Co., Inc., N. Y. C.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Reed-Prentice Corp., Worcester, Mass.

MILLERS, Thread
Adams Co., Dubuque, Iowa
Cleveland Auto. Mach. Co., Cleveland
Coulter Mach. Co., Jas., Bridgeport, Conn.
Hanson-Whitney Mach. Co., Hartford, Conn.
Lees-Bradner Co., Cleveland
Plan-O-Mill Corp., Royal Oak, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Rivett Lathe & Grinder, Inc., Boston
Scherr Co., Inc., Geo., N. Y. C.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Waltham Mach. Works, Waltham, Mass.

MILLERS, Vertical
Blank & Buxton Machy. Co., Jackson, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Coulter Machine Co., James, Bridgeport, Conn.
General Machinery Corp., Hamilton, O.
Gorton Machine Co., Geo., Racine, Wis.
Granite State Mach. Co., Inc., Manchester, N. H.
Hardinge Brothers, Inc., Elmira, N. Y.
Jefferson Mach. Tool Co., Cincinnati
Kearney & Trecker Corp., Milwaukee
Kempsmith Mfg. Co., Milwaukee
Knight Machinery Co., W. B., St. Louis
Linley Bros. Co., Bridgeport, Conn.
Machinery Mfg. Co., Los Angeles
Morey Machinery Co., Inc., N. Y. C.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Reed-Prentice Corp., Worcester, Mass.
Sidney Machine Tool Co., Sidney, O.
Sommer & Adams Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Machine Tool Co., Springfield, Mass.

MOLDING MACHINES, Plastic
Adams Co., Dubuque, Iowa
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Reed-Prentice Corp., Worcester, Mass.
Watson-Stillman Co., Roselle, N. J.

MOLDS, Lead Hammer
Johnson Tool Co., Inc., E. Providence, R. I.

MOLYBDENUM
Molybdenum Corp. of America, Pittsburgh

MOTORS, Electric
Allis-Chalmers Mfg. Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Century Electric Co., St. Louis
Dumore Co., Racine, Wis.
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., Milwaukee
Howell Elec. Motors Co., Howell, Mich.
Lincoln Electric Co., Cleveland
Reliance Elec. & Engrg. Co., Cleveland
Wagner Electric Corp., St. Louis
Wesche Electric Co., B. A., Cincinnati
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

MOTORS, Geared (See MOTORS, Electric)

MOTORS, Hydraulic (see also PUMPS, Hydraulic)
Racine Tool & Mach. Co., Racine, Wis.
Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit

NAMEPLATES
Acromark Co., Elizabeth, N. J.
Matthews & Co., Jas. H., Pittsburgh
Noble & Westbrook Mfg. Co., Hartford, Conn.

NIBBLERS
Campbell, Andrew C., Div. Amer. Chain & Cable Co., Bridgeport, Conn.
Mitts & Merrill, Saginaw, Mich.
Savage Tool Co., Savage, Minn.

NOZZLES, Blast-Cleaning
Norton Company, Worcester, Mass.
Schrader's Sons, A., N. Y. C.
Service Equip. Co., South Gate, Cal.

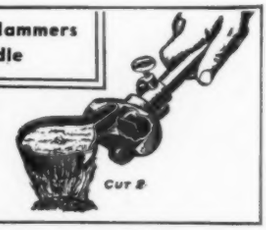
NUMBERING MACHINES (See MARKING MACHINES)

NUT-BLANKING MACHINES
Cleveland Automatic Mach. Co., Cleveland
National Acme Co., Cleveland
Potter & Johnston Machine Co., Pawtucket, R. I.

OIL STONES (See STONES, Sharpening)

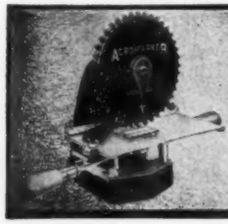
OILERS, Automatic (See LUBRICATING SYSTEMS)

Remelt and Cast Your Lead Hammers with the Field Mould and Ladle



Save time and money—keep lead hammers in good condition at all times—easy to use—fast. Made in 7 sizes for hammers from 1 to 11 lbs. Write for details.
Also, Lead Hammers, sizes 1 to 15 lbs. always in stock.

JOHNSON TOOL CO., INC.
East Providence Rhode Island, U.S.A.



FAST NEW WAY TO STAMP NUMBERS AND LETTERS STRAIGHT

THE ACROMARK CORP.
H. O. BATES
ELIZABETH, N. J.

WHERE-TO-BUY DIRECTORY

OILS, Cutting
Cities Service Co., N. Y. C.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
Racine Tool & Mach. Co., Racine, Wis.
Shell Oil Co., Inc., N. Y. C.
Sinclair Refining Co., N. Y. C.
Socony-Vacuum Oil Co., N. Y. C.
Standard Oil Co. (Ind.), Chicago
Stuart Oil Co., D. A., Chicago
Sun Oil Co., Philadelphia
Swan-Finch Oil Corp., N. Y. C.
Texas Co., N. Y. C.
Tidewater Associated Oil Co., N. Y. C.
White & Bagley Co., Worcester, Mass.

OILS & GREASES (See **LUBRICANTS**)

OILS, Quenching & Tempering
Cities Service Co., N. Y. C.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
Shell Oil Co., Inc., N. Y. C.
Sinclair Refining Co., N. Y. C.
Socony-Vacuum Oil Co., N. Y. C.
Standard Oil Co. (Ind.), Chicago
Stuart Oil Co., D. A., Chicago
Sun Oil Co., Philadelphia
Texas Co., N. Y. C.
Tidewater Oil Co., N. Y. C.

PACKING, Hydraulic
Elmes Engrg. Wks., Chas. F., Chicago
Greene, Tweed & Co., N. Y. C.
Houghton & Co., E. F., Philadelphia
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Watson-Stillman Co., Roselle, N. J.

PAINTS, Varnishes, etc.
Devoe & Raynolds Co., Inc., N. Y. C.

PAPER & CLOTH, Abrasive
Behr-Manning Corp., Troy, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Midwest Abrasive Co., Detroit

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S., Worcester, Mass.

PHOSPHOR BRONZE
Bunting Brass & Bronze Co., Toledo
Johnson Bronze Co., New Castle, Pa.

PICKLING MACHINES (See **METAL-CLEANING EQUIPMENT**)

PINS, Dowel & Taper
Allen Mfg. Co., Hartford, Conn.
American Steel & Wire Co., Cleveland
Bethlehem Steel Co., Bethlehem, Pa.
Danly Machine Specialties, Inc., Chicago
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland

PIPE CUTTING & THREADING MACHINES
Armstrong Bros. Tool Co., Chicago
Bardons & Oliver, Inc., Cleveland
Cleveland Automatic Mach. Co., Cleveland
Hill Acme Co., Cleveland
Landis Mach. Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit
Oster Mfg. Co., Cleveland
Peerless Machine Co., Racine, Wis.
Rickert-Shafer Co., Erie, Pa.
Scherr Co., Inc., Geo., N. Y. C.
Warner & Swasey Co., Cleveland

PLANERS
Cincinnati Planer Co., Cincinnati
The Cleveland Planer, Cleveland
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Mach. Tool Corp., Rochester, N. Y.
General Machinery Corp., Hamilton, O.
Liberty Planers, Inc., Hamilton, O.
Ohio Machine Tool Co., Kenton, O.
Rockford Mach. Tool Co., Rockford, Ill.
Sellers & Co., Inc., Wm., Philadelphia

PLANERS, Plate
Baldwin-Southwark Corp., Philadelphia
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Mach. Tool Corp., Rochester, N. Y.
General Machinery Corp., Hamilton, O.
Ohio Machine Tool Co., Kenton, O.
Sellers & Co., Wm., Philadelphia

PLATES, Angle
Brown & Sharpe Mfg. Co., Providence, R. I.
Lombard Governor Corp., Ashland, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

PLATES, Surface
Baumbach Mfg. Co., E. A., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Mfg. Co., Milwaukee
Lombard Governor Corp., Ashland, Mass.
Machine Products Corp., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Smith Tool & Engrg. Wks., Inc., Bucyrus, Ohio
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

PLATFORMS, SKID (See **TRUCKS, Hand Lift**)

PLATING EQUIPMENT & SUPPLIES
United Chromium, Inc., N. Y. C.

POTENTIOMETERS
Brown Instrument Co., Philadelphia
General Electric Co., Schenectady, N. Y.

POTS, Melting
Farrell-Birmingham Co., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Hones, Inc., Chas. A., Baldwin, N. Y.
Strong, Carlisle & Hammond Co., Cleveland
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

PRESSES, Arbor
American Broach & Machine Co., Ann Arbor, Mich.
Atlas Press Co., Kalamazoo, Mich.
Barnes Co., W. F. & John, Rockford, Ill.
Elmes Engrg. Wks., Chas. F., Chicago
Fameo Machine Co., Racine, Wis.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lempco Products, Inc., Bedford, O.
Lucas Machine Tool Co., Cleveland
Nicholson & Co., W. H. Wilkes-Barre, Pa.
Producto Machine Co., Bridgeport, Conn.

THE IMPROVED LINLEY HIGH SPEED VERTICAL MILLING MACHINE AND JIG BORER

A COST CUTTER ON SMALL PRECISION WORK . . .

This new and improved machine with larger table and more clearance will pay for itself on die, jig and fixture work as well as on molds for plastics, metal pattern work, laying-out, drilling, milling and boring operations.

The Improved Linley is fast and simple and has the correct speeds to insure safety to tools. Ball bearing equipped; micrometer screw feed head.

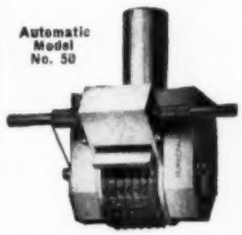
Use the LINLEY for small precision work and release your large machines for heavy work. Investigate today!

Write for descriptive Bulletin M and detailed specifications.

LINLEY BROTHERS CO.
664 State Street Extension
BRIDGEPORT, CONN. U. S. A.

NUMBERALL Numbering Machines
For stamping into metal etc.

Automatic Model No. 50



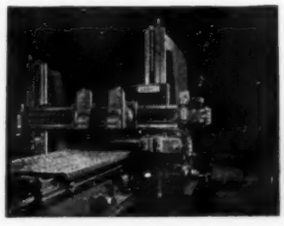
non-automatic Model No. 70

Sturdy construction, precision build, perfectly aligned numbers.
All sizes of figures.
Write for Catalog.

NUMBERALL STAMP & TOOL CO., Inc.
Huguenot Park, Staten Island, N. Y.

LIBERTY HEAVY DUTY PLANERS

NEW IN DESIGN

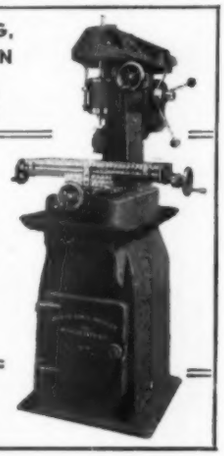


● *featuring:*
.... heavy offset rail heads and tapered gibs
.... triple reduction all steel gear train with herringbone high speed drive and double balanced intermediate drive
.... Universal side heads with power and hand feed vertically and horizontally
.... rapid traverse in all directions
.... push button controlled reversing motor drive
.... electric clamping of cross rails
.... friction type electric feed.

Send for Catalog 152 and 153

LIBERTY PLANERS Inc.
HAMILTON, OHIO

HANDLE YOUR PRECISION MILLING, BORING, FACING AND ROUTING ON THE G&S VERTICAL MILL AND JIG BORER



IDEAL FOR TOOL ROOM OR PRODUCTION

A machine offering wide utility in shops or tool rooms engaged in defense work. Small parts for instruments, arms and munitions can be handled accurately, conveniently, quickly and simply.

Speeds 1150 R.P.M. motor: 276, 547, 948, 1292, 2811
Speeds 1750 R.P.M. motor: 240, 833, 1441, 2433, 4277
Table size: 6½" x 20"
Write for Descriptive Folder

GRANITE STATE MACHINE CO. Inc.
MANCHESTER, NEW HAMPSHIRE
Exclusive Selling Agents: H. Leach Machinery Co.
387 Charles St., Providence, R. I.

If accuracy-PLUS is wanted . . . Get SMITH *MASTER* SURFACE PLATES

AVAILABLE SIZES
8" x 12"
9" x 14"
12" x 18"
18" x 24"
18" x 18"
20" x 30"
24" x 24"
24" x 36"
30" x 36"
30" x 60"
36" x 68"
Other sizes made on order.

Smith Surface Plates will give you the maximum freedom from distortion with a minimum of deflection. Original design insures ample rigidity and stiffness for accurate measuring. Smith Surface Plates are satisfactorily meeting the tests of the country's leading precision toolmakers. You'll want detailed information and descriptive literature. Sent free on request.

SMITH TOOL & ENGINEERING CO.
(Formerly Smith Tool Works, Inc.)
842 N. Sandusky Ave. Bucyrus, Ohio

CONTROLLED FLOW *Saves Power*

Model 11020-A

One of the latest and most modern types of coolant pumps. Intakes and discharge pass through flange directly into machine making a very neat and efficient installation.

RUTHMAN GUSHER COOLANT PUMPS

Gusher Pumps can be throttled to any extent without building up pressure. Power consumption *decreases* when pump is partially or totally throttled. This feature *plus* the elimination of packing glands make Gusher pumps economical and most efficient. These and other *exclusive* features help *speed* your production.

There's a Gusher Pump to fit your needs. Write for data and specifications.

THE RUTHMAN MACHINERY CO.
1809 READING ROAD, CINCINNATI, OHIO
LARGEST EXCLUSIVE BUILDERS OF COOLANT PUMPS

WHERE-TO-BUY DIRECTORY

Sheldon Machine Co., Chicago
Tomkins-Johnson Co., Jackson, Mich.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Buffalo, N. Y.
Wright Mfg. Div., American Chain & Cable Co., York, Pa.

PRESSES, Crank (See **PRESSES, Power**)

PRESSES, Foot
Etna Machine Co., Toledo, O.
Famco Machine Co., Racine, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Nilson Mach. Co., A. H., Bridgeport, Conn.
Rockford Iron Wks., Inc., Rockford, Ill.
V. & O. Press Co., Hudson, N. Y.

PRESSES, Forging
Ajax Mfg. Co., Euclid P. O., Cleveland
Baldwin-Southwark Corp., Philadelphia
Beatty Mach. & Mfg. Co., Hammond, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Clearing Machine Corp., Chicago
Cleveland Punch & Shear Works Co., Cleveland
Elmes Engrg. Wks., Chas. F., Chicago
Hill Acme Co., Cleveland
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Watson-Stillman Co., Roselle, N. J.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, Hydraulic
American Broach & Machine Co., Ann Arbor, Mich.
Atlas Press Co., Kalamazoo, Mich.
Baldwin-Southwark Corp., Philadelphia
Beatty Mach. & Mfg. Co., Hammond, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Clearing Machine Corp., Chicago
Colonial Broach Co., Detroit
Davis Keyseater Co., Rochester, N. Y.
Elmes Engrg. Wks., Chas. F., Chicago
Farrel-Birmingham Co., Ansonia, Conn.
General Machinery Corp., Hamilton, O.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lapointe Mach. Tool Co., Hudson, Mass.
Lempco Products, Inc., Bedford, O.
Tomkins-Johnson Co., Jackson, Mich.
Watson-Stillman Co., Roselle, N. J.
Wright Mfg. Div. Amer. Chain Co. Inc., Bridgeport, Conn.

PRESSES, Power (Punch)
Beatty Mach. & Mfg. Co., Hammond, Ind.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati
Clearing Mach Co., Chicago
Cleveland Crane & Engrg. Co., Steelweld Machry. Div., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., Cleveland.
Consolidated Machine Tool Corp., Rochester, N. Y.
Davis Keyseater Co., Rochester, N. Y.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hendey Machine Co., Torrington, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Kent-Owens Machine Co., Toledo, O.
Lempco Products, Inc., Bedford, O.
Mitts & Merrill, Saginaw, Mich.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Nilson Mach. Co., A. H. Bridgeport, Conn.
Rockford Iron Wks., Inc., Rockford, Ill.
Ryerson & Son, Inc., Jos. T., Chicago
Schatz Mfg. Co., Poughkeepsie, N. Y.
V. & O. Press, Hudson, N. Y.
Wiedemann Machine Co., Philadelphia
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, Screw
Barnes Co., W. F. & John, Rockford, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Producto Machine Co., Bridgeport, Conn.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Wright Mfg. Div., American Chain & Cable Co., York, Pa.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, Straightening
Baldwin-Southwark Corp., Philadelphia
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Elmes Engrg. Wks., Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Nilson Mach. Co., A. H., Bridgeport, Conn.
Springfield Mach. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

PRESSES, Turret Punch
Federal Press Co., Elkhart, Ind.
Wiedemann Machine Co., Philadelphia

PROFILERS (See **MILLERS, Vertical**)

PROJECTORS, Contour
Jones & Lamson Machine Co., Springfield, Vt.
Portman Machine Tool Co., Mt. Vernon, N. Y.
Scherr Co., Geo., N. Y. C.

PROTECTORS, Motor
Spencer Thermostat Co., Attleboro, Mass.

PROTRACTORS, Optical
Scherr Co., Geo., N. Y. C.

PULLEYS, Iron, Steel & Wood
American Pulley Co., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Carlyle Johnson Machine Co., Manchester, Conn.
Dayton Rubber Mfg. Co., Dayton, O.
Hill Acme Co., Cleveland
Reeves Pulley Co., Columbus, Ind.

PULLEYS, V-Belt (See **SHEAVES, V-Belt**)

PUMPS, Centrifugal
Allis-Chalmers Mfg. Co., Milwaukee
Brown & Sharpe Mfg. Co., Providence, R. I.
Pioneer Engrg. & Mfg. Co., Detroit
Ruthman Machry. Co., Cincinnati
Tomkins-Johnson Co., Jackson, Mich.

PUMPS, Hydraulic
Allis-Chalmers Mfg. Co., Milwaukee
Baldwin-Southwark Corp., Philadelphia
Barnes Co., W. F. & John, Rockford, Ill.
Elmes Engrg. Wks., Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lapointe Mach. Tool Co., Hudson, Mass
Racine Tool & Machine Co, Racine, Wis.
Sundstrand Mach. Tool Co., Rockford, Ill.
Tuthill Pump Co., Chicago
Vickers, Inc., Detroit
Watson-Stillman Co., Roselle, N. J.

PUMPS, Lubricant and Coolant
Brown & Sharpe Mfg. Co., Providence, R. I.
Buffalo Forge Co., Buffalo, N. Y.
Gray Mills Co., Chicago
Pioneer Engrg. & Mfg. Co., Detroit
Rivett Lathe & Grinder, Inc., Boston
Ruthman Machinery Co., Cincinnati
Sundstrand Mach. Tool Co., Rockford, Ill.
Tompkins-Johnson Co., Jackson, Mich.
Tuthill Pump Co., Chicago
Vickers, Inc., Detroit

PUNCHES, Center & Hand (See **TOOLS, Hand**)

PURIFIERS, Oil & Coolant
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.
Sparkler Mfg. Co., Mundelein, Ill.

PYROMETERS, Indicating & Recording
Brown Instrument Co., Philadelphia

QUENCHERS
American Gas Furn. Co., Elizabeth, N. J.
Electric Furnace Co., Salem, O.
Farrel-Birmingham Co., Buffalo, N. Y.
Gleason Works, Rochester, N. Y.

RACKS, Gear (See **GEARS, Cut**)

RASPS (See **FILES & RASPS**)

RATCHETS (See **GEARS, Cut**)

REAMERS, Adjustable
Barber-Colman Co., Rockford, Ill.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Detroit
Cleveland Twist Drill Co., Cleveland
Colonial Broach Co., Detroit
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sculiy-Jones & Co., Chicago
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.

REAMERS, Pipe
American Swiss File & Tool Co., Elizabeth, N. J.
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Cleveland Twist Drill Co., Cleveland
Detroit Tap & Tool Co., Detroit
Gairing Tool Co., Detroit
Greenfield Tap & Die Corp., Greenfield, Mass.

WHERE-TO-BUY DIRECTORY

Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Oster Mfg. Co., Cleveland
Standard Tool Co., Cleveland
Torrington Co., Torrington, Conn.

REAMERS, Shell
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Greenfield Tap & Die Corp., Greenfield, Mass.
Illinois Tool Works, Chicago
Morse Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Schultz & Anderson Co., Newark, N. J.
Union Twist Drill Co., Athol, Mass.

REAMERS, Solid
Barber-Colman Co., Rockford, Ill.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., N. Y. C.
Holman Reamer Co., Manchester, Conn.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Wendt Sonis Co., Hannibal, Mo.

REAMING MACHINES
Blanchard Machine Co., Cambridge, Mass.
Barnes Co., W. F. & John, Rockford, Ill.
Cleveland Pneu. Tool Co., Cleveland
Rotor Tool Co., Cleveland
Van Norman Machine Tool Co., Springfield, Mass.

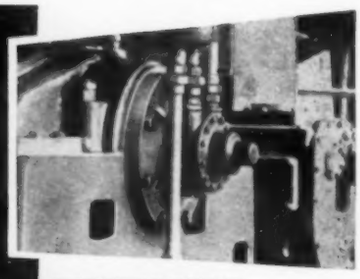
RECORDERS, Speed (See **INDICATORS, Speed**)

RECORDERS, Temperature & Pressure
Brown Instrument Co., Philadelphia

REDUCERS, Motorized Speed
Adams Co., Dubuque, Iowa
Allis-Chalmers Mfg. Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Dumore Co., Racine, Wis.
Earle Gear & Machine Co., Philadelphia
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
James Co., D. O., Chicago
Meisel Press Mfg. Co., Boston, Mass.
Ohio Gear Co., Cleveland
Philadelphia Gear Works, Philadelphia
Reliance Elec. & Engrg. Co., Cleveland
Wagner Electric Corp., St. Louis
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

REDUCERS, Speed
Adams Co., Dubuque, Iowa
Davis & Thompson Co., Milwaukee
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
General Machinery Corp., Hamilton, O.
Grant Gear Works, Inc., Boston
James Co., D. O., Chicago
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland
Philadelphia Gear Works, Philadelphia
Racine Tool & Mach. Co., Racine, Wis.

STRIPPED FOR ACTION



TUTHILL

"STRIPPED" PUMPS

SAVE MATERIAL, SPACE AND MONEY

To save vital material, space and money, Tuthill offers dependable "stripped" pumps for direct incorporation into the design of the machine. Positive displacement, internal-gear, rotary type. Compact. Durable. Capacities from 1 to 50 g.p.m.

● Write for Tuthill Stripped Pump Catalog

Series "S" Series "SA"

Tuthill Series S are pumps without supporting brackets, shown above. Available with automatic reversing and internal by-passing features.

Tuthill Series SA provide only the pumping elements, including gears, cover and crescent. Ideal for built-in applications where special porting is necessary or mounting space limited.

Tuthill PUMP COMPANY
939 EAST 95TH STREET • Chicago

SPECIFY ALL TOOLS BY OUR LIST NUMBERS

S. & A. ARBORS FOR SHELL REAMERS

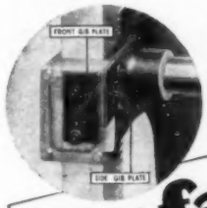
WITH TAPER SHANKS • CARBON STEEL

Number	Price Each	Fitting Size Reamer	Length Overall Inches	Morse Taper Shank
RA6	$3.95	1-1/16—1-9/32	10	3
RA7	4.30	1-5/16—1/21/32	11	3
RA8	4.80	1-11/16—2	12	4
RA9	5.40	2-1/16—2-1/2	13	4

WITH STRAIGHT SHANKS • CARBON STEEL

Number	Price Each	Fitting Size Reamer	Length Overall Inches
RA6	$3.30	1-1/16—1-9/32	10
RA7	3.60	1-5/16—1-21/32	11
RA8	4.00	1-11/16—2	12
RA9	4.50	2-1/16—2-1/2	13

SCHULTZ & ANDERSON CO.
MACHINE TOOLS
109 EDISON PLACE, NEWARK, N. J.
Market 2-4318-4319



Simple adjustment of front and side gib plates gives positive control of ram alignment — eliminates any variance.

ONLY famco OFFERS ADJUSTABLE GIBS!

You can always be sure of perfect ram alignment with Famco's exclusive adjustable gib control. Standard on all Famco Arbor Presses, it compensates for wear . . . eliminates "shimmy." That's why Famco Presses can step up production and assembly jobs in your plant. Write today for complete facts on Bench and floor types. *40 stock sizes* . . . half ton to 15 tons pressure.

FAMCO MACHINE COMPANY
1800-18th Street, Racine, Wis.

No. 8C Floor Type Arbor Press

famco FOOT AND ARBOR PRESSES

DANLY *Knurled*

All Die Makers' Supplies
Danly Commercial Sets
Danly Special Sets

SOCKET-HEAD CAP SCREWS
HOLLOW SET SCREWS
DANLY MACHINE SPECIALTIES, INC.
2100 South 52nd Avenue, Chicago, Illinois
MILWAUKEE • LONG ISLAND CITY, N. Y.
DAYTON • DETROIT • ROCHESTER
CLEVELAND • PHILADELPHIA
DUCOMMUN METALS & SUPPLY CO.
Los Angeles • San Francisco

DANLY PRECISION DIE SETS

Safety..Speed..Hand Freedom!
JUNKIN SAFETY GUARDS

Junkin Safety Guards operate as an actual part of your presses—no complicated attachments . . . keep workmen at highest efficiency by safety that is automatic . . . operator's hands are always free. Patented Tripie Interlock controls barrier gate so that it is in a protective position during every working stroke of the ram.

SEND FOR FREE BOOKLET
Describing Junkin Guards

JUNKIN SAFETY APPLIANCE CO., Inc.
934 West Hill Street - - Louisville, Kentucky

GRANT

RIVETERS—PIONEERS in their line—head rivets from smallest to 5/8" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.

Write for literature and don't forget to send samples.

THE GRANT MFG. & MACHINE CO.
85 Sillman Ave., Bridgeport, Conn., U. S. A.

HOLMAN
Helical Taper Pin Reamer

Made from selected steel by the most modern processes. Circular and price list No. 2 on request.

for finishing holes for taper pins economically BETTER - FASTER

HOLMAN REAMER CO., Manchester, Conn.

WHERE-TO-BUY DIRECTORY

REELS, Strip-Stock & Wire
Nilson Mach. Co., A. H., Bridgeport, Conn.
Yoder Co., Cleveland

REFRACTORIES
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.
Strong, Carlisle & Hammond Co., Cleveland

REFRIGERATORS, Industrial
Deep Freeze Div., Motor Products Corp., Chicago

REGULATORS, Speed
Vickers, Inc., Detroit

REGULATORS, Temperature
American Gas Furn. Co., Elizabeth, N. J.
Barber-Colman Co., Rockford, Ill.
Brown Instrument Co., Philadelphia

RIFLING MACHINES, Gun
American Broach & Machine Co., Ann Arbor, Mich.
Illinois Tool Works, Chicago
LeBlond Mach. Tool Co., R. K., Cincinnati
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

RIVETERS, Electric Power
Buffalo Forge Co., Buffalo, N. Y.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Linley Bros. Co., Bridgeport, Conn.
Tomkins-Johnson Co., Jackson, Mich.

RIVETERS, Pneumatic & Hydraulic
Baldwin-Southwark Corp., Philadelphia
Cleveland Pneu. Tool Co., Cleveland
Elmes Engrg. Wks., Chas. F., Chicago
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Watson-Stillman Co., Roselle, N. J.

RIVETS
Aluminum Co. of America, Pittsburgh
American Steel & Wire Co., Pittsburgh
Bethlehem Steel Co., Bethlehem, Pa.

ROLLS, Bending
Baldwin-Southwark Corp., Philadelphia
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N.Y.
General Machinery Corp., Hamilton, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ryerson & Son, Inc., Jos. T., Chicago

ROLLS, Forging
Ajax Mfg. Co., Cleveland
Bethlehem Steel Co., Bethlehem, Pa.

ROPE, Wire
American Cable Div. of Am. Chain & Cable Co., N. Y. C.
Bethlehem Steel Co., Bethlehem, Pa.
Page Steel & Wire Div., Am. Chain & Cable Co., Monessen, Pa.
Roebling's Sons Co., John A., Trenton, N. J.
Ryerson & Son, Inc., Jos. T., Chicago

ROUTERS
Consolidated Mach. Tool Corp., Rochester, N. Y.
Gorton Machine Co., Geo., Racine, Wis.
Knight Machy. Co., W. R., St. Louis
Onsrud Machine Works, Chicago
Reed-Prentice Corp., Worcester, Mass.

RULES, Machinists'
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

RUSTPROOFING & SLUSHING COMPOUNDS
Bakelite Corp., N. Y. C.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
Oakite Products Co., N. Y. C.
Socony-Vacuum Oil Co., Inc., N. Y. C.
Standard Oil Co. of Indiana, Chicago
Tidewater Oil Co., N. Y. C.

SAFETY EQUIPMENT
American Optical Co., Southbridge, Mass.
Junkin Safety Appliance Co., Louisville, Ky.
Littleford Bros., Cincinnati

SANDERS, Machine & Portable
Black & Decker Mfg. Co., Towson, Md.
Carborundum Co., Niagara Falls, N. Y.
Delta Mfg. Co., Milwaukee
Haskins Co., R. G., Chicago
Jefferson Machine Tool Co., Cincinnati
Mattison Machine Works, Rockford, Ill.
Porter-Cable Mach. Co., Syracuse, N. Y.
Production Mach. Co., Greenfield, Mass.
Rotor Tool Co., Cleveland
Skilsaw, Inc., Chicago
Stow Mfg. Co., Binghamton, N. Y.
Strand Co., N. A., Chicago
Walker-Turner Co., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

SAW BLADES, Circular Metal-Cutting
Atkins & Co., E. C., Indianapolis
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg., Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland

SAW BLADE GRINDING FIXTURES
Industrial Engineering Co., Inc., Minneapolis

SAW BLADES, Hack & Band (See **BLADES, Hack & Band-Saw**)

SAWS, Band, Metal-Cutting (Machines)
Armstrong-Blum Mfg. Co., Chicago
Atkins & Co., E. C., Indianapolis
Avey Drilling Mach. Co., Cincinnati
Capewell Mfg. Co., Hartford, Conn.
Continental Machines, Inc., Minneapolis
Delta Mfg. Co., Milwaukee
Peerless Machine Co., Racine, Wis.
Racine Tool & Machine Co., Racine, Wis.
Reed-Prentice Corp., Worcester, Mass.
Ryerson & Son, Inc., Jos. T., Chicago
Starrett Co., L. S., Athol, Mass.
Walker-Turner Co., Plainfield, N. J.

SAWS, Circular, Metal-Cutting (Machines)
Consolidated Mach. Tool Corp., Rochester, N. Y.
Delta Mfg. Co., Milwaukee
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Earle Gear Machine Co., Philadelphia
Motch & Merryweather Co., Cleveland
Porter-McLeod Machine Tool Co., Hatfield, Mass.

SAWS, Circular, Wood-Cutting (Machine)
Atkins & Co., E. C., Indianapolis
Curtis Pneumatic Machy. Co., St. Louis
Delta Mfg. Co., Milwaukee
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Mattison Machine Works, Rockford, Ill.
Walker-Turner Co., Inc., Plainfield, N. J.

SAWS, Friction
Ryerson & Son, Inc., Jos. T., Chicago

SAWS, Hack (See **TOOLS, Hand**)

SAWS, Hole
Armstrong-Blum Co., Chicago
Atkins & Co., E. C., Indianapolis
Avey Drilling Mach. Co., Cincinnati
Black & Decker Mfg. Co., Towson, Md.
Earle Gear & Machine Co., Philadelphia
Schrader's Sons, A., N. Y. C.
Skilsaw, Inc., Chicago

SAWS, Portable (See **TOOLS, Portable**)

SAWS, Power Hack
Armstrong-Blum Mfg. Co., Chicago
Atkins & Co., E. C., Indianapolis
Capewell Mfg. Co., Hartford, Conn.
Covel Mfg. Co., Benton Harbor, Mich.
L-W Chuck Co., Toledo, Ohio
Oster Mfg. Co., Cleveland
Peerless Machine Co., Racine, Wis.
Racine Tool & Mach Co., Racine, Wis.
Ryerson & Son, Inc., Jos. T., Chicago

SCRAPERS, Hand (See **TOOLS, Hand**)

SCRAPERS, Power
Black & Decker Mfg. Co., Towson, Md.

SCREWDRIVERS, Flexible-Shaft (See **TOOLS, Flexible-Shaft**)

SCREWDRIVERS, Hand (See **TOOLS, Hand**)

SCREWDRIVERS, Portable Electric & Pneumatic (See **TOOLS, Portable**)

SCREWDRIVING & NUT-SETTING MACHINES
Bodine Corp., Bridgeport, Conn.
Haskins Co., R. G., Chicago
Producto Machine Co., Bridgeport, Conn.
Schauer Machine Co., Cincinnati
Strand & Co., N. A., Chicago

SCREW-MACHINES, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Foote-Burt Co., Cleveland

WHERE-TO-BUY DIRECTORY

Greenlee Bros. & Co., Rockford, Ill.
National Acme Co., Cleveland
New Britain-Gridley Mach. Div., New Britain, Conn.
Scherr Co., Inc., George, N. Y. C.
Warner & Swasey Co., Cleveland

SCREW-MACHINES, Plain & Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Jones & Lamson Mach. Co., Springfield, Vt.
National Acme Co., Cleveland
Rivett Lathe & Grinder, Inc., Boston
Warner & Swasey Co., Cleveland

SCREW PLATES (See **DIES, Screw-Cutting, Adjustable**)

SCREWS, Cap and Set
Allen Mfg. Co., Hartford, Conn.
Baumbach Mfg. Co., E. A., Chicago
Danly Machine Specialties, Inc., Chicago
Eastern Machine Screw Corp., New Haven, Conn.
National Acme Co., Cleveland
Parker-Kalon Corp., N. Y. C.
Republic Steel Corp., Cleveland, O.
Standard Pressed Steel Co., Jenkintown, Pa.
Strong, Carlisle & Hammond Co., Cleveland

SCREWS, Machine
Allen Mfg. Co., Hartford, Conn.
Eastern Machine Screw Corp., New Haven, Conn.
Lamson & Sessions Co., Cleveland
Republic Steel Co., Cleveland
Strong, Carlisle & Hammond Co., Cleveland

SCREWS, Recessed Head
American Screw Co., Providence, R. I.
Central Screw Co., Chicago
Chandler Products Corp., Cleveland
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
International Screw Co., Detroit
National Screw & Mfg. Co., Cleveland
New England Screw Co., Keene, N. H.
Parker Co., Charles, Meriden, Conn.
Parker-Kalon Corp., N. Y. C.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Mfg. Co., Chicago, Ill.
Phillips Screw Mfrs. Providence, R. I.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Shakeproof Lock Washer Co., Chicago
Southington Hardware Mfg. Co., Southington, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
Whitney Screw Corp., Nashua, N. H.

SCREWS, Self-Tapping
Parker-Kalon Corp., N. Y. C.

SCREWS, Thumb & Wing
Parker-Kalon Corp., N. Y. C.

SCRIBERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

SEPARATORS, Centrifugal
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.
National Acme Co., Cleveland
Sparkler Mfg. Co., Mundelein, Ill.

SETS, Rivet
American Swiss File & Tool Co., Elizabeth, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., Cleveland

SETTERS, Nut (See **TOOLS, Portable**)

SHAFTING, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Earle Gear & Mach. Co., Philadelphia
Jones & Laughlin Steel Corp., Pittsburgh
National Tube Co., Pittsburgh
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Union Drawn Steel Co., Massillon, O.
Wyckoff Drawn Steel Co., Pittsburgh

SHAFTS, Flexible
Dumore Co., Racine, Wis.
Errington Mech. Lab., Stapleton, N. Y.
Haskins Co., R. G., Chicago
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand Co., N. A., Chicago
Walker-Turner Co., Inc., Plainfield, N. J.

SHAPERS
American Tool Works Co., Cincinnati
Ames Co., B. C., Waltham, Mass.
Atkins & Co., E. C., Indianapolis
Atlas Press Co., Kalamazoo, Mich.
Automotive Maintenance Machinery Co., N. Chicago, Ill.
Bryant Machinery & Engrg. Co., Chicago
Cincinnati Shaper Co., Cincinnati
Hanson-Whitney Mach. Co., Hartford, Conn.
Hendey Machine Co., Torrington, Conn.
Machinery Mfg. Co., Los Angeles
Morey Machinery Co., Inc., N. Y. C.
Ohio Machine Tool Co., Kenton, O.
Pratt & Whitney Div., Niles-Bement-Bond Co., Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Rockford Mach. Tool Co., Rockford, Ill.
Smith & Mills Co., Cincinnati

SHARPENERS, Saw
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
Weldon Tool Co., Cleveland

SHAVING MACHINES
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Michigan Tool Co., Detroit

SHEARS, Hand
Black & Decker Mfg. Co., Towson, Md.
Buffalo Forge Co., Buffalo, N. Y.
George Mchy. Co., James W., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Minneapolis

SHEARS, Rotary
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Detroit Tap & Tool Co., Detroit
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ryerson & Son, Inc., Jos. T., Chicago
Schatz Mfg. Co., Poughkeepsie, N. Y.

SHEARS, Squaring
Beatty Mach. & Mfg. Co., Hammond, Ind.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati
Cleveland Crane & Engrg. Co., Wickliffe, O.
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Kent-Owens Machine Co., Toledo, O.
Mitts & Merrill, Saginaw, Mich.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Schatz Mfg. Co., Poughkeepsie, N. Y.

SHEAVES, "V" Belt
Allis-Chalmers Mfg. Co., Milwaukee
American Pulley Co., Philadelphia
Dayton Rubber Mfg. Co., Dayton, O.
Earle Gear & Machine Co., Philadelphia
Gates Rubber Co., Denver, Colo.
Hill Acme Co., Cleveland

SHEET-METAL WORKING MACHINERY (See **BRAKES, Bending Press; DIES, Sheet-Metal; Forming Machines; NIBBLERS; PRESSES; REELS, Stripstock; RIVETERS; ROLLS, Bending; SHEARS; STITCHERS, Metal**)

SHELL-MAKING Machinery
Bullard Co., Bridgeport, Conn.
Colman & Sons, Frederick, Detroit
Hepburn American Co., Greenwich, Conn.
Morey Machinery Co., Inc., N. Y. C.

SHIPPING SERVICE
Railway Express, All Principal Cities

SKIDS (See **TRUCKS, Hand**)

SLEEVES & SOCKETS, Drill
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland
Greenfield Tap & Die Corp., Greenfield, Mass.
Hardinge Brothers, Inc., Elmira, N. Y.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

SLOTTERS
Baker Bros., Inc., Toledo, O.
Consolidated Machine Tool Corp., Rochester, N. Y.
Douglas Machinery Co., Inc., N. Y. C.
General Machinery Corp., Hamilton, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

SOCKETS, Drill (See **SLEEVES & SOCKETS, Drill**)

SOLVENTS, Oil & Grease
Detroit Rex Products Co., Detroit
Oakite Products, Inc., N. Y. C.

SPINDLES, Machine
Bryant Chucking Grinder Co., Springfield, Vt.
Dumore Co., Racine, Wis.
Ex-Cell-O Corp., Detroit
Heald Machine Co., Worcester, Mass.
Monarch Machine Tool Co., Sidney, O.
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago

SPRAYERS, Paint
Ideal Commutator Dresser Co., Chicago

SPRINGS, Die
Allen Mfg. Co., Hartford, Conn.
Danly Machine Specialties, Chicago

SPROCKETS (See **GEARS, Cut**)

SQUARES, Precision (See **BLOCKS, Precision Gage**)

STAMPINGS, Metal
Acromark Corp., Elizabeth, N. J.
American Brass Co., Waterbury, Conn.
Continental Machines, Inc., Minneapolis
Revere Copper & Brass Inc., N. Y. C.
Standard Pressed Steel Co., Jenkintown, Pa.
Sundstrand Mach. Tool Co., Rockford, Ill.

STAMPS & HOLDERS, Steel, Safety
Acromark Corp., Elizabeth, N. J.
Cunningham Co., M. E., Pittsburgh
Moore Mfg. Co., Wm., Chicago
Noble & Westbrook Mfg. Co., East Hartford, Conn.

STAMPS, Steel (See **DIES, Marking & Embossing**)

STARTERS, Motor (See **CONTROLLERS, Motor**)

STEEL, Die
Allegheny Ludlum Steel Corp., Pittsburgh
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Ryerson & Son, Inc., Jos. T., Chicago
Timken Steel & Tube, Div., Canton, O.
Vanadium Alloys Steel Co., Pittsburgh

STEEL-MILL PRODUCTS
Allegheny-Ludlum Steel Corp., Pittsburgh (Steel and stainless steel sheets, plates, tubes, wire and strip)
American Steel & Wire Co., Cleveland (Cold-finished bars, wire and wire products)
Bethlehem Steel Co., Bethlehem, Pa.
Bissett Steel Co., Cleveland (Tubing)
Boker & Co., Inc., H., N. Y. C.
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Darwin & Milner, Cleveland
Disston & Sons, Inc., Henry, Philadelphia
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc. Div. Borg-Warner Corp., New Castle, Ind.
Jones & Laughlin Steel Corp., Pittsburgh
Latrobe Elec. Steel Co., Latrobe, Pa.
Republic Steel Corp., Cleveland

SCARCITY OF HIGH SPEED POWER HACK SAW BLADES

Defense requirements for High Speed Steel is diverting this necessary metal to other channels. This will make it difficult to secure delivery of High Speed Blades without long delays. Many industrial concerns have solved this problem by regrinding their blades ten and more times. *Write for descriptive folder.*

Industrial Engineering Co., Inc.
311 Sixth Avenue South, MINNEAPOLIS
P. O. Box 433, MINNESOTA

NEED SUB-CONTRACT HELP?

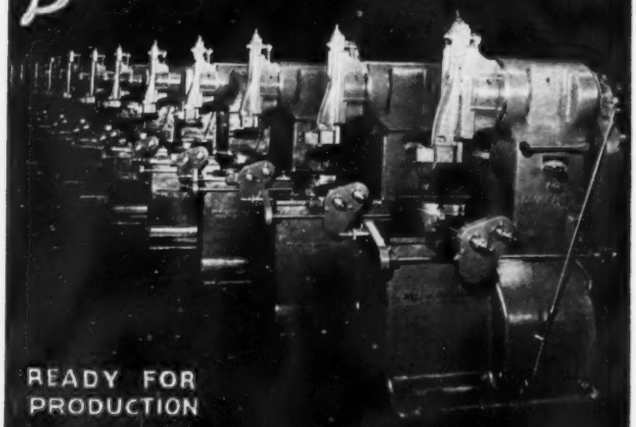
Consult the Contract Work Section in this issue. If you can't find what you want there, write.

CONTRACT WORK DEPT.
AMERICAN MACHINIST 330 West 42nd St., N.Y.C.

SMITH & MILLS
CRANK SHAPERS
sizes 12" to 32" stroke
THE SMITH & MILLS CO. Cincinnati, Ohio

Douglas

PRECISION SLOTTER
BUILT WITH 7", 8", 10" STROKE



READY FOR PRODUCTION

SWIVELING RAM HEAD AND TOOL HOLDER, AUTOMATIC CIRCULAR TABLE AND INDEPENDENT AUTOMATIC FEEDS IN ALL DIRECTIONS

EARLY DELIVERY BY LARGE SCALE PRODUCTION

DOUGLAS MACHINERY CO. INC.
150 BROADWAY NEW YORK, N. Y.

DARWIN & MILNER, Inc.
1260 West 4th St. Cleveland, O.

Original Patentees & Pioneers
of HIGH CARBON-HIGH CHROME
Quantity Production Steels

"NEOR"
"COBALTCROM-PRK-33"

The latter also in the form of

CASTINGS

ALL KINDS OF HIGH-GRADE

TOOL-STEELS

Booth C-118
NATIONAL METAL EXPOSITION
CLEVELAND, OHIO
October 12-16th, 1942

WHERE-TO-BUY DIRECTORY

Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Timken Steel & Tube Div., Canton, O.
Union Drawn Steel Co., Massillon, O. (Cold-finished)
Vanadium Alloys Steel Co., Pittsburgh
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.
Wyckoff Drawn Steel Co., Pittsburgh

STEEL, Stainless (See preceding classification)

STEEL, Tool
Allegheny-Ludlum Steel Corp., Pittsburgh
Armstrong Bros. Tool Co., Chicago
Bethlehem Steel Co., Bethlehem, Pa.
Carnegie-Illinois Steel Corp., Pittsburgh
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., Cleveland
Climax Molybdenum Co., N. Y. C.
Columbia Steel Co., San Francisco
Copperweld Steel Co., Glassport, Pa.
Darwin & Milner, Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Ingersoll Steel & Disc, Div. Borg-Warner Corp., New Castle, Ind.
Latrobe Elec. Steel Co., Latrobe, Pa.
Republic Steel Corp., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Timken Steel & Tube Div., Canton, O.
United States Steel Corp., Pittsburgh
Vanadium Alloys Steel Co., Pittsburgh
Wheelock, Lovejoy Co., Inc., Cambridge, Mass.

STERILIZERS, Oil
Barrett Co., Leon J., Worcester, Mass.

STOCKS, Dies & Cutters, Pipe
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland
Pratt & Whitney Co., Div. Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Standard Tool Co., Cleveland

STONES, Sharpening
Bay State Abrasive Products Co., Westboro, Mass.
Behr-Manning Corp., Troy, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Midwest Abrasive Co., Detroit

STRAIGHTEDGES (See DIE-MAKERS' SUPPLIES)

STRAIGHTENERS, Wire
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Springfield Mach. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

STRAIGHTENING & SIZING MACHINES
Taylor Wilson Mfg. Co., McKees Rocks, Pa.

STRIPPERS, Wire
Ideal Commutator Dresser Co., Chicago

SUB-PRESSES & DIES (See Dies, Sub-press)

SUPERFINISHING EQUIPMENT
Ultra-Lap Mach. Co., Detroit

SURFACE-BROACHING MACHINES (See BROACHING MACHINES)

SURFACE PLATES (See PLATES, Surface)

SWAGING MACHINES
Etna Machine Co., Toledo
Hardinge Brothers, Inc., Elmira, N. Y.
Torrington Co., Torrington, Conn.

SWITCHES, Electric
Adam Electric Co., Frank, St. Louis
Allen-Bradley Co., Milwaukee
Allis-Chalmers Mfg. Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Brown Instrument Co., Philadelphia
Clark Controller Co., Cleveland
General Electric Co., Schenectady, N. Y.
L-W Chuck Co., Toledo, O.
Square D Co., Milwaukee
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

SWITCHES, Limit
Adam Electric Co., Frank, St. Louis
Allen-Bradley Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Clark Controller Co., Cleveland
General Electric Co., Schenectady, N. Y.
National Acme Co., Cleveland
Square D Co., Milwaukee
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

SYSTEMS, Production & Tool Control
McCaskey Register Co., Alliance, O.

TABLES, Elevating Portable
Hamilton Tool Co., Hamilton, O.

TACHOMETERS (See INDICATORS, Speed)

TANKS & CYLINDERS, Air
Anker Holth Mfg. Co. (Airgrip Chuck Div.) Port Huron, Mich.
Clearing Machine Corp., Chicago
Curtis Pneu. Machinery Co., St. Louis
National Tube Co., Pittsburgh
Tomkins-Johnson Co., Jackson, Mich.

TAPER PINS (See PINS, Dowel & Taper)

TAPES, Measuring
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

TAPPERS, Single & Multi-Spindle
Armstrong-Blum Mfg. Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Baker Bros., Inc., Toledo, O.
Barber-Colman Co., Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bodine Corp., Bridgeport, Conn.
Bradford Mach. Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Buhr Mach. Tool Co., Ann Arbor, Mich.
Bullard Co., Bridgeport, Conn.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati-Gilbert Machine Tool Co., Cincinnati
Delta Mfg. Co., Milwaukee
Etteo Tool Co., Brooklyn, N. Y.
Foote-Burt Co., Cleveland
Geometric Tool Co., New Haven, Conn.
Goss & deLeeuw Machine Co., New Britain, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hamilton Tool Co., Hamilton, O.
Haskins Co., R. G. Chicago
Hill Acme Co., Cleveland
Kingsbury Mach. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Murchey Mach. & Tool Co., Detroit
National Acme Co., Cleveland
National Auto. Tool Co., Richmond, Ind.
Rickert-Shafer Co., Erie, Pa.
Snyder Tool & Engrg. Co., Detroit

TAPS, Adjustable (See DIES, Adjustable)

TAPS, Hand & Machine, Solid
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Detroit Tap & Tool Co., Detroit
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Machine Co., Hartford, Conn.
Landis Machine Co., Waynesboro, Pa.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Threadwell Tap & Die Co., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Wood & Spencer Co., Cleveland

TESTING EQUIPMENT, Tension & Compression
Baldwin-Southwark Corp., Philadelphia
Hartford Special Machinery Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.

THREADING MACHINES, Die-Head
Brown & Sharpe Mfg. Co., Providence, R. I.
Dalzen Tool & Mfg. Co., Detroit
Eastern Mach. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., Detroit
Geometric Tool Co., New Haven, Conn.
Grant Mfg. & Machine Co., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., Cleveland
Lees-Bradner Co., Cleveland
Murchey Machine & Tool Co., Detroit
Oster Mfg. Co., Cleveland
Rickert-Shafer Co., Erie, Pa.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Waltham Mach. Wks., Waltham, Mass.
Warner & Swasey Co., Cleveland

THREADING MACHINES, Roll
Brown & Sharpe Mfg. Co., Providence, R. I.
Hill Acme Co., Cleveland
V. & O. Press Co., Hudson, N. Y.

THERMOMETERS, Dial
Brown Instrument Co., Philadelphia
Strong, Carlisle & Hammond Co., Cleveland

TOOL HOLDERS (See HOLDERS, Tool)

TOOL POSTS, Lathe
Armstrong Bros. Tool Co., Chicago

WHERE-TO-BUY DIRECTORY

Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Boring
Armstrong Bros. Tool Co., Chicago
Bullard Co., Bridgeport, Conn.
Carboloy Co., Detroit, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Heald Machine Co., Worcester, Mass.
Illinois Tool Works, Chicago
Lucas Machine Tool Co., Cleveland
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Sturdimatic Tool Co., Detroit
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Burring
Nobur Mfg. Co., Los Angeles

TOOLS and PARTS, Cemented-Carbide
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford, Ill.
Carboloy Co., Inc., Detroit
Crafts Co. Inc., Arthur A., Boston
Detroit Tap & Tool Co., Detroit
Disston and Sons, Inc., Henry, Tacony, Philadelphia
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Grayson Mfg. Co., Monrovia, Cal.
Illinois Tool Works, Chicago
McKenna Metals Co., Latrobe, Pa.
Metal Carbides Corp., Youngstown, O.
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Sheffield Corp., Dayton, O.
Tungsten Elec. Corp., Union City, N. J.
Vanadium Alloys Steel Co., Pittsburgh
Vascoloy-Ramet Corp., Chicago
Warner & Swasey Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Diamond-Tipped
Crafts Co., Arthur A., Boston
Desmond-Stephen Mfg. Co., Urbana, O.
Diamond Tool Co., Chicago
Gorton Machine Co., Geo., Racine, Wis.
Kent-Owens Machine Co., Toledo, O.
Norton Company, Worcester, Mass.
Smit & Son, J. K., N. Y. C.

TOOLS, Flexible-Shaft
Dumore Co., Racine, Wis.
Haskins Co., R. G., Chicago
Ideal Commutator Dresser Co., Chicago
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand & Co., N. A., Chicago
Walker-Turner, Inc., Plainfield, N. J.

TOOLS, Hand
Allen Mfg. Co., Hartford, Conn.
American Swiss File & Tool Co., Elizabeth, N. J.
Armstrong-Blum Mfg. Co., Chicago
Armstrong Bros. Tool Co., Chicago
Atkins & Co., F. C., Indianapolis
Automotive Maintenance Machy. Co., No. Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Capewell Mfg. Co., Hartford, Conn.
Carboloy Co., Detroit
Card Mfg. Co., S. W., Mansfield, Mass.
Cleveland Punch & Shear Works Co., Cleveland
Cleveland Twist Drill Co., Cleveland
Crafts Co., Arthur A. Boston
Dearborn Gage Co., Dearborn, Mich.
Disston & Sons, Inc., Henry, Philadelphia
Elastic Stop Nut Corp., Union, N. J.
Errington Mech. Lab., Stapleton, N. Y.
Gairing Tool Co., Detroit
Greene, Tweed & Co., N. Y. C.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hamilton Tool Co., Hamilton, O.
Lufkin Rule Co., Saginaw, Mich.
National Twist Drill & Tool Co., Detroit
Niagara Mach. & Tool Wks., Buffalo, N. Y.
North Bros. Mfg. Co., Philadelphia
Numberall Stamp & Tool Co., Huguenot Park, N. Y.
Plomb Tool Co., Los Angeles
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Racine Tool & Mach. Co., Racine, Wis.
Scully-Jones & Co., Chicago
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Thompson & Son Co., Henry G., New Haven, Conn.
Union Twist Drill Co., Athol, Mass.
Victor Saw Works, Inc., Middletown, N. Y.
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Knurling (See Knurls & Knurl Holders)

TOOLS, Lathe, Shaper and Planer
American Tool Works Co., Cincinnati
Armstrong Bros. Tool Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Auto Ordnance Corp., Bridgeport, Conn.
Blake Co., Edward, Newton Centre, Mass.
Bullard Co., Bridgeport, Conn.
Carboloy Co., Detroit
Cincinnati Lathe & Tool Co., Cincinnati
Cleveland Twist Drill Co., Cleveland
Colonial Broach Co., Detroit
Empire Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Genesee Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Haynes Stellite Co., N. Y. C.
Hendey Machine Co., Torrington, Conn.
Illinois Tool Works, Chicago
Jefferson Mach. Tool Co., Cincinnati
LeBlond Mach. Tool Co., R. K., Cincinnati
McKenna Metals Co., Latrobe, Pa.
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
Nobur Mfg. Co., Los Angeles
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Ready Tool Co., Bridgeport, Conn.
Rivett Lathe & Grinder, Inc., Boston
Scully-Jones & Co., Chicago
Starrett Co., L. S., Athol, Mass.
Sturdimatic Tool Co., Detroit
Vascoloy-Ramet Corp., N. Chicago, Ill.
Warner & Swasey Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

TOOLS, Portable Electric
Black & Decker Mfg. Co., Towson, Md.
Chicago Wheel & Mfg. Co., Chicago
Delta Mfg. Co., Milwaukee
Dremel Mfg. Co., Racine, Wis.
Dumore Co., Racine, Wis.
Foredom Electric Co., N. Y. C.
George Mchy. Co., James W., Detroit
Hisey-Wolf Machine Co., Cincinnati
Rotor Tool Co., Cleveland
Schauer Machine Co., Cincinnati
Skilsaw, Inc., Chicago
Walker-Turner Co., Plainfield, N. J.

TOOLS, Portable Pneumatic
Cleveland Pneu. Tool Co., Cleveland
Onsrud Machine Works, Inc., Chicago
Rotor Tool Co., Cleveland
Sheldon Machine Co., Chicago

TOOLS, Stellite
Haynes Stellite Co., N. Y. C.

TORCHES, Gas-Cutting & Welding
Air Reduction, N. Y. C.

TRANSMISSIONS, Hydraulic
American Engrg. Co., Philadelphia
Barnes Co., W. F. & John, Rockford, Ill.
Elmes Engrg. Wks., Chas. F., Chicago
Ex-Cell-O Corp., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit

TRANSMISSIONS, Mech. Variable-Speed
Allis-Chalmers Mfg. Co., Milwaukee
Continental Machine, Inc., Minneapolis
Earle Gear & Machine Co., Philadelphia
Ideal Commutator Dresser Co., Chicago
Morse Chain Co., Ithaca, N. Y.
Reeves Pulley Co., Columbus, Ind.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

TROLLEYS, TRACKS & TRAMWAYS, Overhead
American Steel & Wire Co., Cleveland
Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Cleveland Crane & Engineering Co., Wickliffe, O.
Cullen-Friestedt Co., Chicago
Curtis Pneu. Machinery Co., St. Louis
Ford Chain Block Div. Am. Chain & Cable Co., Inc., Philadelphia, Pa.
Harnischfeger Corp., Milwaukee
Mathews Conveyor Co., Ellwood City, Pa.
Standard Conveyor Co., No. St. Paul, Minn.
Wright Mfg. Div. Am. Chain & Cable Co., Inc., York, Pa.

ALLOY

S.A.E. HY-TEN N.E.

STEELS

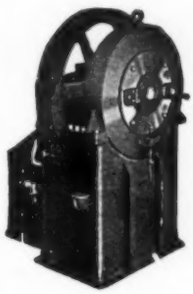
We solicit your inquiries

Even though warehouse stocks today are not as plentiful as you and we would like there are still a substantial number of sizes in a variety of analyses available for immediate shipment. We will do everything within our power to help you make the guns and tools and ships and planes and tanks which will win the war.

Wheelock, Lovejoy & Co., Inc.

Main Offices: 137 Sidney St. Cambridge, Mass.

Cleveland, Chicago, Newark, Detroit, Buffalo, Cincinnati



THE TORRINGTON ROTARY SWAGING MACHINE

— with 4000 forceful squeezing hammer blows per minute—makes metal tougher and more elastic. Send for booklet—"The Torrington Swaging Machine."

The Torrington Co., Swager Dept.
56 Field Street Torrington, Conn.

DIAMONDS for Victory

BIG-HED-NIBS
LOC-KEY-SET

RE-SET-ABLE
Cooler dressing
Closer Tolerances
Micrometer Accuracy
Because: Wing key heat dissipation and absolute diamond lock nib.

• Three grades of diamonds. Common quality $12 per karat. Medium quality $24 per karat. Select quality $48 per karat. (Contour template diamonds supplied only in Medium and Select quality.)

All diamond sizes ¼ to 10 karat are nib mounted for immediate shipment . . . Billed subject to approval. Specify quality of diamond wanted. We recommend a minimum size of one karat for each 6" diameter of grinding wheel. (24 hour resetting service, $1.00 post paid.) Grinders instruction card free.

Send specifications and prices for prices on turning and boring form tools.

DIAMOND TOOL COMPANY, Not Inc.
Sheldon M. Booth, Pres.
931 E. 41st Street CHICAGO, ILL.

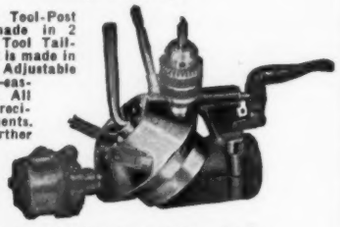
DON'T WAIT FOR TURRET LATHES

CONVERT YOUR ENGINE LATHE INTO A TURRET LATHE IN 15 SECONDS

To fit Bench lathes and lathes up to 24" swing.
Designed to increase production.
15 days delivery.

Pat. Pending

The 4 Tool Tool-Post Turret is made in 2 sizes. The 5 Tool Tail-Stock Turret is made in 4 sizes. Also Adjustable Full Feed—easily attached. All tools are precision attachments. Write for further details.

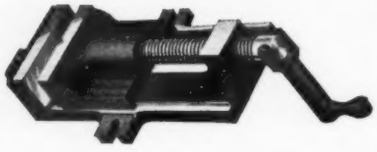


Also — Jefferson Precision Milling Machines, Milling Machine Dividing Heads, Vises, Belt Sanders, Swing Frame Grinders, Gyratory Foundry Riddles.

JEFFERSON MACHINE TOOL CO.

So. Sweeney, Cutter & Fourth Sts. Cincinnati, Ohio

YOST DRILL PRESS VISE



This new Yost vise has been designed expressly for use on drill press operations. Does away with special and costly jig fixtures.

Offered in two sizes.

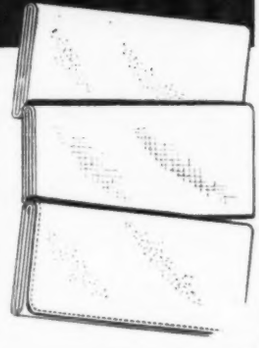
Vise No.	Width of Jaw, Inches	Opens Inches	Weight Pounds
1D	3½	3½	12½
2D	5	5½	23

Do you need a vise of ANY type?
Write today for bulletins on the extensive Yost line

YOST MFG. COMPANY

1335 So. Main St. Meadville, Pennsylvania

WIPING CLOTHS, CHEESECLOTHS, AND TOWELS TO LICK ANY CLEANING JOB YOU'VE GOT!



Every cleaning job you have requires a special wiping cloth. BURCOTT's selection of wipers and towels includes the exact wiper you need. Not just cheap wiping rags you use once and throw away, but soft absorbent top-quality materials you launder and use over and over again. Discover the economies of BURCOTT's specialized wipers and towels used by war industries all over America. Send for **FREE** samples and prices of the wipers or towels you need —no agent will call.

BURCOTT MILLS

620-D West Fulton St. Chicago, Illinois

LELAND-GIFFORD COMPANY · WORCESTER MASS. U.S.A. · MACHINE TOOLS · CRANK SHAFTS

Drilling and Tapping Machines

(Automatic and Semi-Automatic)

LELAND GIFFORD CO.

— WORCESTER, MASS.

Today's Production Schedules demand "SIMPLIFIED"

arc welding

Because new operators feel right at home with the efficient, years-ahead designed Hobart Welder.

Hobart Bros., Box A.M. 10-1 Troy, O.

"One of the World's Largest Builders of Arc Welders."

FREE

Catalog gives Specifications, Models and Uses.

WHERE-TO-BUY DIRECTORY

TRUCKS, Hand
Standard Pressed Steel Co., Jenkintown, Pa.

TUBING, Steel
Bissett Steel Co., Cleveland
Ryerson & Son, Inc., Jos. T., Chicago
Timken Steel & Tube Co., Canton, Ohio

TURRETS, Tool-post & Tailstock
Gisholt Machine Co., Madison, Wis.
Jefferson Machine Tool Co., Cincinnati
McCrosky Tool Corp., Meadville, Pa.
Warner & Swasey Co., Cleveland

UNITS, Drilling, Reaming & Tapping
Barnes Co., W. F. & John, Rockford, Ill.
Kingsbury Mach. Tool Corp., Keene, N. H.

UPSETTERS (See Forging Machines)

USED MACHINERY (See Searchlight Section)

V BLOCKS (See Blocks, V)

VALVES, Air-Control
Atkins & Co., E. C., Indianapolis
Barber-Colman Co., Rockford, Ill.
Curtis Pneu. Machinery Co., St. Louis
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Ross Operating Valve Co., Detroit
Schrader's Son, A., Brooklyn, N. Y.
Tomkins-Johnson Co., Jackson, Mich.

VALVES, Hydraulic
Baldwin-Southwark Corp., Philadelphia
Barnes Co., W. F. & John, Rockford, Ill.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Elmes Engrg. Wks., Chas. F., Chicago
Nicholson & Co. W. H., Wilkes-Barre, Pa.
Racine Tool & Mach. Co., Racine, Wis.
Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit
Watson-Stillman Co., Roselle, N. J.

VERNIERS
Brown & Sharpe Mfg. Co., Providence, R. I.

VISES, Air-Operated
Ross Operating Valve Co., Detroit
Tomkins-Johnson Co., Jackson, Mich.

VISES, Machine
Armstrong Bros. Tool Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago Wheel & Mfg. Co., Chicago
Cincinnati Milling Mach. Co., Cincinnati
Cincinnati Planer Co., Cincinnati
Cincinnati Shaper Co., Cincinnati
Covel Mfg. Co., Benton Harbor, Mich.
Desmond-Stephan Mfg. Co., Urbana, O.
Fenn Mfg. Co., Hartford, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hartford Special Machinery Co., Hartford, Conn.
Hendey Machine Co., Torrington, Conn.
Jefferson Mach. Tool Co., Cincinnati
Johnson Tool Co., E. Providence, R. I.
Kearney & Trecker Corp., Milwaukee
Knight Mach. Co., W. B., St. Louis
L-W Chuck Co., Toledo, O.
North Bros. Mfg. Co., Philadelphia
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Yost Mfg. Co., Meadville, Pa.

VISES, Machinists' Bench
Atlas Press Co., Kalamazoo, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati
Desmond-Stephan Mfg. Co. Urban, O.
Fenn Mfg. Co., Hartford, Conn.
Fray Machine Tool Co., Glendale, Calif.
Jefferson Mach. Tool Co., Cincinnati
New Britain-Gridley Machine Co., New Britain, Conn. (Stands)
North Bros. Mfg. Co., Philadelphia
Wiedemann Machine Co., Philadelphia

VISES, Pipe
Armstrong Bros. Tool Co., Chicago
Desmond-Stephan Mfg. Co., Urban, O.
Greenfield Tap & Die Corp., Greenfield, Mass.

WASHING & DRYING, Machines (See METAL-CLEANING EQUIPMENT)

WELDERS, Arc
Air Reduction, N. Y. C.
Allis-Chalmers Mfg. Co., Milwaukee
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., Milwaukee
Hobart Bros. Co., Troy, O.
Lincoln Electric Co., Cleveland
Westinghouse Elec. & Mfg. Co. E. Pittsburgh, Pa.

WELDERS, Resistance
Ohio Machine Tool Co., Kenton, O.

WELDERS, Spot
Ohio Machine Tool Co., Kenton, O.
Progressive Welder Co., Detroit

WELDING ACCESSORIES
Clark Controller Co., Cleveland
Cullen-Friestedt Co., Chicago
Lincoln Electric Co., Cleveland
Mallory & Co., Inc., P. R., Indianapolis (Electrode Holders)

WELDING CONTROLS
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., Cleveland

WELDING EQUIPMENT
Bayard & Co., Inc., M. L., Philadelphia
General Electric Co., Schenectady, N. Y.

WELDING POSITIONERS
Cullen-Friestedt Co., Chicago

WELDING RODS
Air Reduction, N. Y. C.
Allegheny-Ludlum Steel Corp., Pittsburgh
Aluminum Co. of America, Pittsburgh
American Brass Co., Waterbury, Conn.
American Steel & Wire Co., Cleveland
Atkins & Co., E. C., Indianapolis
Harnischfeger Corp., Milwaukee
Haynes Stellite Co., N. Y. C.
Hobart Bros. Co., Troy, O.
Lincoln Electric Co., Cleveland
McKay Co., Pittsburgh
Page Steel & Wire Div., Am. Chain & Cable Co., Monessen, Pa.
Revere Copper & Brass Corp., N. Y. C.
Roebling's Sons Co., John A., Trenton, N. J.
Ryerson & Son, Inc., Jos. T., Chicago
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

WELDING TIMERS
Lincoln Electric Co., Cleveland

WELDING TIPS
Mallory & Co., Inc., P. R., Indianapolis

WHEELS, Grinding & Polishing
Bakelite Corp., N. Y. C.
Bay State Abrasive Products Co., Westboro, Mass.
Blanchard Mach. Co., Cambridge, Mass.
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Carborundum Co., Niagara Falls, N. Y.
Chicago Wheel & Mfg. Co., Chicago
Cincinnati Milling Mach. Co., Cincinnati
deSanno & Son, Inc., A. P., Phoenixville, Pa.
Gardner Machine Co., Beloit, Wis.
Macklin Co., Jackson, Mich.
Midwest Abrasive Co., Detroit
Norton Co., Worcester, Mass.
Porter-Cable Mach. Co., Syracuse, N. Y.
Roberts Rubber Co., Weldon, Newark, N. J.
Sterling Grinding Wheel Co., Tiffin, O.
Vitrified Wheel Co., Westfield, Mass.

WINDERS, Coil
Ideal Commutator Dresser Co., Chicago

WIPING CLOTHS
Burcott Mills, Chicago

WIRE, Spring
American Brass Co., Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Firth-Sterling Steel Co., McKeesport, Pa.
Jones & Laughlin Steel Corp., Pittsburgh
Page Steel & Wire Div. Amer. Chain & Cable Co., Inc., Monessen, Pa.
Revere Copper & Brass Inc., N. Y. C.

WIRES, Measuring
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

WOODWORKING MACHINERY
Barnes Co., W. F. & John, Rockford, Ill.
Capewell Mfg. Co., Hartford, Conn.
Delta Mfg. Co., Milwaukee
Diehl Mach. Wks., G. M., Wabash, Ind.
Greenlee Bros. & Co., Rockford, Ill.
Jefferson Mach. Tool Co., Cincinnati
Mattison Machine Works, Rockford, Ill.
Walker-Turner Co., Plainfield, N. J.

WRENCHES, Open End
Armstrong Bros. Tool Co., Chicago
Plomb Tool Co., Los Angeles
Williams & Co., J. H., Buffalo, N. Y.

WRENCHES, Pipe
Armstrong Bros. Tool Co., Chicago
Standard Tool Co., Cleveland
Williams & Co., J. H., Buffalo, N. Y.

WRENCHES, Ratchet
Allen Mfg. Co., Hartford, Conn.
North Bros. Mfg. Co., Philadelphia
Williams, J. H. & Co., Buffalo, N. Y.

WRENCHES, Socket
Armstrong Bros. Tool Co., Chicago
Greene, Tweed & Co., N. Y. C.
Plomb Tool Co., Los Angeles
Williams & Co., J. H. Buffalo, N. Y.

WRENCHES, Tap
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Errington Mech. Lab., Stapleton, N. Y.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Williams & Co., J. H., Buffalo, N. Y.

ADVERTISERS INDEX

	Page
Abrasive Machine Tool Co.	167
Acme Machine Tool Co.	32
Acromark Corp.	248
Adams Co.	116
Allegheny Ludlum Steel Corp.	45
Allen Manufacturing Co.	134
Allis-Chalmers Mfg. Co.	67
American Chain & Cable Co., Inc.	137, 162
American Gas Furnace Co.	105
American Metal Works, Inc.	233
American Screw Co.	76c
American Steel & Wire Co.	88, 89
American Swiss File & Tool Works	132
American Tool Works Co.	22, 23
Ames Co., B. C.	240, 247
Anker-Holth Manufacturing Co.	117
Armstrong-Blum Mfg. Co.	76d
Armstrong Bros. Tool Co.	76a
Arter Grinding Machine Co.	172
Atkins Co., E. C.	83
Atlantic Machinery Corp.	243, 248
Atometric Precision Gage Laboratories, Inc.	232
Automotive Maintenance Machry Co.	203
Auto-Ordnance Corp.	37, 146
Avey Drilling Machine Co.	44
Axelson Mfg. Co.	165
Baker Brothers, Inc.	149
Baldwin Southwark Div. of Baldwin Locomotive Works	99
Ball & Roller Bearing Co.	233
Bantam Bearings Corp.	130
Barber-Colman Co.	26
Bardons & Oliver, Inc.	52
Barnes Drill Co.	244
Bartelt Engineering	240
Baumbach Mfg. Co., E. A.	232
Bearings Co. of America	134
Behr-Manning Corp.	176
Black & Decker Mfg. Co.	90, 91
Blanchard Machine Co.	58
Blank & Buxton Machinery Co.	201
Blount Co., J. G.	142
Boggis & Co., H. P.	174
Bradford Machine Tool Co.	156
Braun Gear Co.	114
Bristol Co.	76c
Brown & Sharpe Mfg. Co.	135
Brown Instrument Co.	87
Bryant Chucking Grinder Co.	18, 19
Buffalo Forge Co.	186
Buhr Machine Tool Co.	186
Bullard Co.	61
Burcott Mills	256
Cadillac Gage Co. (Ed.)	1146
Campbell, Andrew C., Div. American Chain & Cable Co., Inc.	137
Capewell Mfg. Co. (Ed.)	1146
Carborundum Co.	160, 168, 169
Card Mfg. Co., S. W. (Div. Union Twist Drill Co.)	182
Carlton Machine Tool Co.	238
Carnegie-Illinois Steel Corp.	88, 89
Carpenter Steel Co.	28, 29
Central Screw Co.	76c
Century Electric Co.	129
Chandler Products Corp.	76c
Chicago Metal Hose Corp.	210
Chisholm Moore Hoist Corp.	195
Cincinnati Bickford Tool Co.	69
Cincinnati Gear Co.	116
Cincinnati Gilbert Machine Tool Co.	239
Cincinnati Grinders, Incorporated	10, 11
Cincinnati Lathe & Tool Co.	247
Cincinnati Milling Machine Co.	4, 5
Cincinnati Planer Co.	248
Cincinnati Shaper Co.	72
Clearing Machine Corp.	49
Cleveland Hobbing Machine Co.	76h
Cleveland Punch & Shear Works Co.	24
Cleveland Twist Drill Co.	157
Climax Molybdenum Co. (Ed.)	1135
Colonial Broach Co. (Ed.)	1137
Columbia Steel Co.	88, 89
Columbus McKinnon Chain Corp.	195
Comtor Co.	241
Cone Automatic Machine Co., Inc.	25
Consolidated Machine Tool Corp.	21
Continental Can Co.	84
Continental Screw Co.	76c
Corbin Screw Corp.	76c
Coulter Machine Co., James	146
Crafts Co., Inc., Arthur	236
Cullen-Friestedt Co.	106
Danly Machine Specialties, Inc.	252
Darwin & Milner	254
Davis Keyseater Co.	244
Deep Freeze Div. Motor Product Corp.	109
Defiance Machine Works, Inc.	145
DeLaval Separator Co.	96, 97
Desmond-Stephan Mfg. Co.	239
Detroit Rex Products Co.	173
Devoe & Raynolds Co., Inc.	120
Diamond Tool Co.	255
Disston & Sons, Inc., Henry	143
Dodge Mfg. Corp.	125
Douglas Machinery Co., Inc.	254
Drive-All Manufacturing Co.	131
Earle Gear & Machine Co.	114
Eastern Machine Screw Corp.	200
Elastic Stop Nut Corp.	144
Electric Furnace Co.	108
Errington Mechanical Laboratory	208
Etna Machine Co.	206
Ettco Tool Co.	231
Excello Corp.	60
Experimental Tool & Die Co.	244
Famco Machine Co.	251
Federal Bearings Co., Inc.	185
Federal Press Co.	204
Federal Products Corp.	124
Federal Tool Co.	195
Fellows Gear Shaper Co.	8, 9
Fenn Mfg. Co.	56
Firth-Sterling Steel Co.	34, 35
Fitchburg Grinding Machine Corp.	133
Foote Bros. Gear & Machine Co.	113
Foote-Burt Co.	55
Foredom Electric Co.	208
Fosdick Machine Tool Co.	30, 31
Fray Machine Tool Co.	76f
Gallmeyer & Livingston Co.	175
Ganschow Gear Co.	112
Gear Grinding Machine Co.	141
Gear Specialties, Inc.	116
General Electric Co.	48, 65
General Machinery Corp. (Mass.)	243
Geometric Tool Co.	171
Giddings & Lewis Machine Tool Co.	Insert between 76 and 77
Gisholt Machine Co.	54
Gleason Works	3
Gorton Machine Co., George	46
Goss & de Leeuw Machine Co.	148
Granite State Machine Co.	249
Grant Gear Works	112
Grant Mfg. & Machine Co.	252
Gray-Mills Co.	119
Grayson Mfg. Co.	193
Greene, Tweed & Co.	179
Gulf Oil Corp.	79
Hamilton Tool Co.	238
Hammond Machinery Builders, Inc.	118, 158, 200, 242
Hanson-Whitney Machine Co.	64
Hardinge Brothers, Inc.	59
Harnischfeger Corp.	82, 180
Hartford Special Machinery Co.	116, 198
Haskins Co., R. G.	180
Haynes Stellite Co., Div. Union Carbide & Carbon Corp.	102
Heald Machine Co.	2nd Cover
Hendey Machine Co.	121
Henry and Wright Mfg. Co.	199
Hill-Acme Co.	151
Hobart Brothers Co.	256
Holman Reamer Co.	252
Hones, Inc., Chas. A.	100
Ideal Commutator Dresser Co.	234
Industrial Engineering Co., Inc.	253
Ingersoll Steel & Disc Div. Borg Warner Corp.	95
International Screw Co.	76c
James Co., D. O.	114
Jefferson Machine Tool Co.	256
Johnson Bronze Co.	127
Johnson Machine Co., Carlyle	110
Johnson Tool Co.	248
Jones & Lamson Machine Co.	6, 7
Jones & Laughlin Steel Corp. (Ed.)	1139
Junkin Safety Appliance Co.	252
Kempsmith Machine Co.	33
Kingsbury Machine Tool Corp.	57
Knight Machinery Co., W. B.	194
Lamson & Sessions Co.	76c
Landis Machine Co.	14, 15
Landis Tool Co.	62, 63
Leach Machinery Co., H.	178
LeBlond Machine Tool Co., R. K.	3rd Cover
Lee Co., K. O.	243
Lees-Bradner Co.	20
Leland-Gifford Co.	256
Lempco Products, Inc.	197
Liberty Planers, Inc.	249
Lincoln Park Tool & Gage Co.	128
Lindberg Engineering Co.	107
Linley Brothers Co.	249
Lipe Rollway Corp.	138
Littleford Bros.	246
Lodge & Shipley Machine Tool Co.	36
Lombard Governor Corp.	178, 179
Lucas & Sons, Inc., J. L.	159
Lucas Machine Tool Co.	232
Lufkin Rule Co. (Ed.)	1144
McCaskey Register Co.	66
McGraw-Hill Book Co., Inc.	136, 184, 188
McKay Co.	76b
McKenna Metals Co.	144
McKnight & McKnight	232
Machinery Manufacturing Co.	198
Magnus Chemical Co.	118
Mallory & Co. Inc., P. R.	78
Marlin Rockwell Corp.	93
Masback Hardware Co., Inc.	76e
Mathews Conveyer Co. (Ed.)	1145
Meisel Press Mfg. Co.	112
Metal Textile Corp.	110
Micromatic Hone Corp.	38, 39
Mid-West Abrasive Co.	17

ADVERTISERS INDEX

(Continued from preceding page)

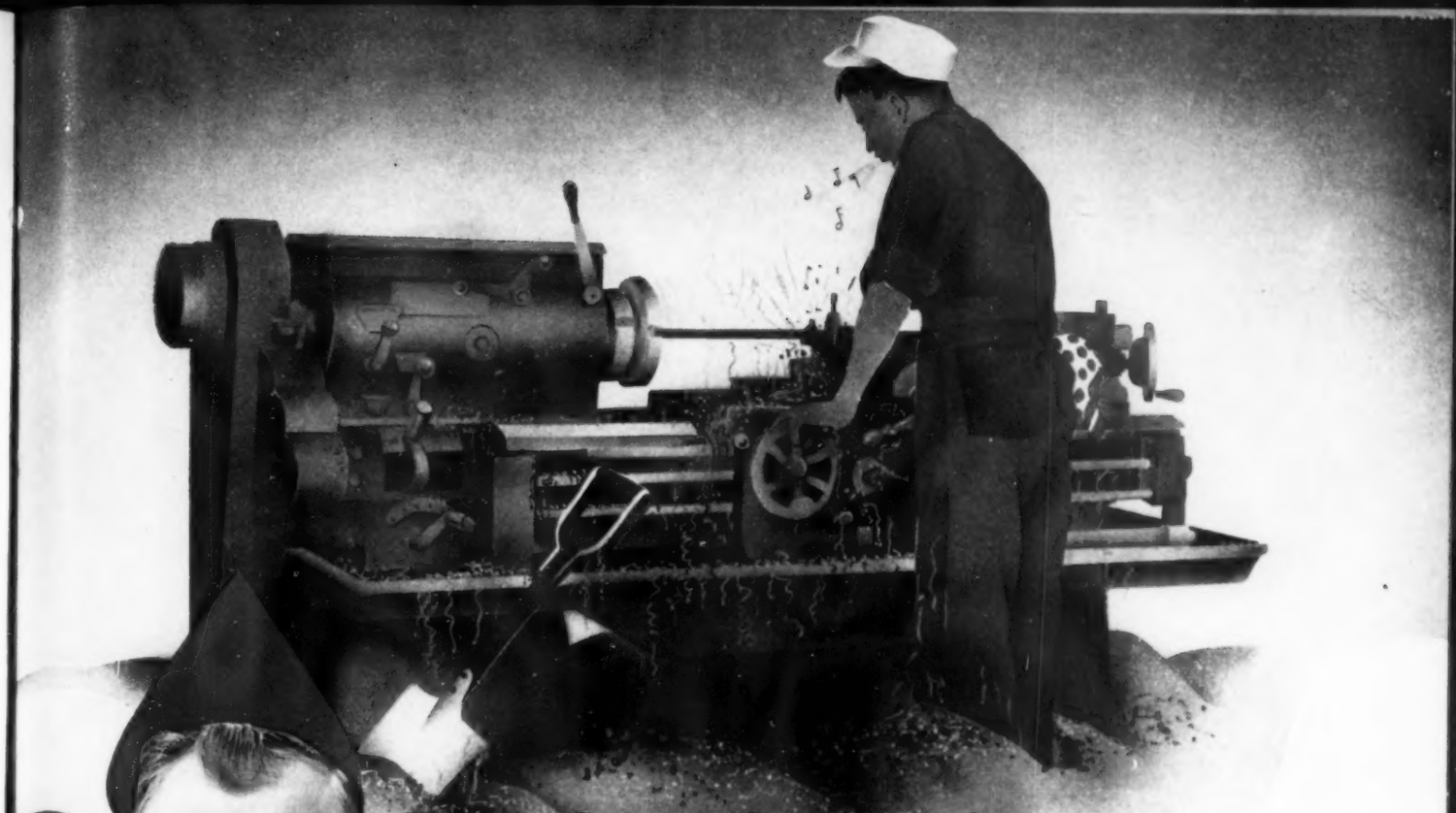
	Page
Mill Supplies	153
Mitts & Merrill	236
Moline Tool Co.	182
Mollart Engineering Co. Ltd.	119
Molybdenum Corp. of America	80
Monarch Machine Tool Co. (Ed.)	1129
Moore Mfg. Co., Wm.	238
Moore Special Tool Co. Inc.	147
Morey Machinery Co. Inc.	148, 176, 196, 200
Motch & Merryweather Co.	209
Murchey Machine & Tool Co.	192
Murray Mfg. Co., D. J.	245
National Acme Co.	191
National Machine Tool Co.	236
National Screw & Mfg. Co.	76c
National Tube Co.	88, 89
National Twist Drill & Tool Co.	155
Newark Gear Cutting Machine Co.	114
New Britain-Gridley Machine Co. (Ed.)	1126
New England Screw Co.	76c
Nichols & Sons, W. H.	190
Nicholson & Co., W. H.	246
Nicholson File Co.	76
Nilson Machine Co., A. H.	202
Norma-Hoffmann Bearings Corp.	94
Norton Co.	42, 43
Numberall Stamp & Tool Co., Inc.	249
Ohio Gear Co.	115
Oliver Instrument Co.	236
O'Neil-Irwin Mfg. Co.	233
Oster Mfg. Co.	189
Parker Co., Chas.	76c
Parker-Kalon Corp.	76c
Pawtucket Screw Co.	76c
Peerless Machine Co.	205
Perkins Machine & Gear Co.	112
Pheoll Mfg. Co.	76c
Philadelphia Gear Works	111
Phillips Screw Mfgrs.	76c
Plomb Tool Co.	122
Porter-McLeod Machine Tool Co. Inc.	208
Potter & Johnston Machine Co.	27
Pratt & Whitney Div. Niles-Bement-Pond Co.	85, 86
Preis Engraving Machine Co., H. P.	239
Production Machine Co.	242
Producto Machine Co.	204
Racine Tool & Machine Co.	154
Railway Express Agency Inc.	136
Randall & Stickney	241
Ready Tool Co.	244
Reed-Prentice Corp.	164
Revere Copper & Brass Inc. (Ed.)	1131
Rivett Lathe & Grinder, Inc.	139
Roberts Rubber Co., Weldon	150
Rockford Iron	202
Rockford Machine Tool Co.	161
Roebling's Sons Co., John A. (Ed.)	1147
Ross Operating Valve Co. (Ed.)	1150
Russell-Burdsall & Ward Bolt & Nut Co.	76c
Ruthman Machinery Co.	250
Sav-Way Tool & Machinery Co. (Ed.)	1148
Schatz Mfg. Co.	126
Schauer Machine Co.	247
Scherr Co., George	123
Schultz & Anderson Co.	172, 251
Scovill Mfg. Co.	76c
Sellers & Co., Inc., Wm.	101
Seneca Falls Machine Co.	163
Service Equipment Co.	179
Shakeproof Inc.	76c
Sheffield Corp. (Ed.)	1149
Sheldon Machine Co.	246
Shore Instrument & Mfg. Co. Inc.	244
Sidney Machine Tool Co.	40
Simmons Machine Tool Corp.	50
Sinclair Refining Co.	92
Smallpeice Ltd.	140
Smit & Sons Inc., J. K.	237
Smith & Mills Co.	253
Smith Tool & Engineering Works	250
Snyder Tool Engineering Co.	183
South Bend Lathe Works	53
Southington Hardware Mfg. Co.	76c
Sparkler Mfg. Co.	110
Specht Engineering Co.	241
Spencer Thermostat Co.	98
Springfield Machine Tool Co.	47
Stahl Gear & Machine Co.	114
Standard Gage Co., Inc.	68
Standard Pressed Steel Co.	232
Standard Tool Co.	177
Stark Tool Co.	76g
Starrett Co., L. S. (Ed.)	1124
Sterling Grinding Wheel Division	166
Stow Mfg. Co.	106
Stuart Oil Co. Ltd., D. A. (Ed.)	1141
Sturdimatic Tool Co.	235
Sunnen Products Co.	170
Sun Oil Co. (Ed.)	1133
Sundstrand Machine Tool Co.	152
Surface Combustion Corp.	103
Swan-Finch Oil Corp.	104
Taylor Machine Co.	112
Tennesse Coal, Iron & R.R. Co.	88, 89
Texas Co.	81
Timken Roller Bearing Co.	4th Cover
Tomkins-Johnson Co.	187
Torrington Co.	255
Trundle Engineering Co. (Ed.)	1142
Tuthill Pump Co.	251
Ultra-Lap Machine Co.	245
Union Carbide & Carbon Corp.	102
Union Twist Drill Co.	16
U. S. Steel Corp.	88, 89
Universal Boring Machine Co.	181
Universal Engineering Co.	148
V. & O. Press Co. Inc.	241
Van Norman Machine Tool Co.	12, 13
Vascoloy-Ramet Corp.	77
Victor Machinery Exchange, Inc.	162
Vitrified Wheel Co.	174
Walker Co. Inc., O. S.	142
Walls Sales Corp.	242
Waltham Machine Works	176
Warner & Swasey Co.	70
Waterbury Steel Ball Co.	231
Weldon Tool Co.	190
Wendt Sonis Co. (Ed.)	1140
Westinghouse Electric & Mfg. Co.	41
Wheelock Lovejoy & Co. Inc.	255
Whitney Screw Corp.	76c
Williams & Co., J. H.	207
Wilson, K. R.	51
Wilson Mechanical Instrument Co. Inc.	245
Wood & Spencer Co. (Ed.)	1143
Wright Mfg. Div. American Chain & Cable Co. Inc.	162
Wyckoff Drawn Steel Co.	73
Yoder Sales Co.	184
Yost Mfg. Co.	256

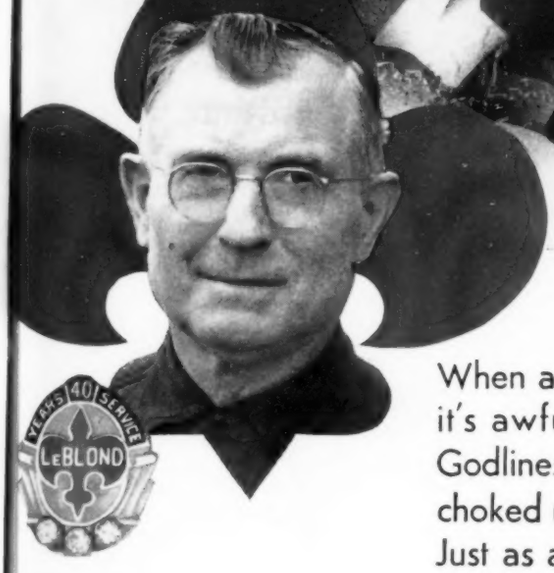
PROFESSIONAL SERVICES 214

SEARCHLIGHT SECTION

Classified Advertising

Classification	*Page*
BUSINESS OPPORTUNITIES	214
CONTRACT WORK SECTION	212-213
Abbott Ball Co.	213
Agerstrand Corp.	212
Barton Machine & Tool Co.	213
Eastern Tool & Mfg. Co.	212
Fidelity Machine Co.	213
Gas Model Research Co.	212
General Pattern Works	212
Gest Engrg. & Equipment Co.	213
Greist Mfg. Co.	212
Haida Engrg. Co.	212
Holmes & Bros., Inc., Robt.	213
King Foundries, Inc.	212
Kirk & Blum Mfg. Co.	213
Lewis Engrg. Co., Stephen J.	212
M & M Mfg. Corp.	213
Machinery Builders, Inc.	212
Maryland Machine Co.	212
Nilson Machine Co., A. H.	212
Norlipp Co.	213
Ohmstede Machine Works	212
Precision Parts, Inc.	212
Queen City Steel Treating Co.	212
Reed Machine & Tool Engr.	213
Reliance Machine & Mfg. Co.	213
Secrest Co., Lawrence W.	213
Thomas & Skinner Steel Products Co.	213
Vandegrift Co., C.	212
Waltham Screw Co.	213
PATENT ATTORNEY	214
POSITIONS VACANT	214
POSITIONS WANTED	214
REBUILDING SERVICE	217, 218, 221, 226
Botwinik Bros., Inc.	218
Lake Machinery Co.	226
Leach Machinery Co., H.	218
Machinery Dealers Nat'l Assoc.	221
Simmons Machine Tool Corp.	217
WANTED TO PURCHASE	214-221
USED SURPLUS EQUIPMENT	214-???
Aaron Machinery Co.	226
Acme Equipment Company	229
Adams Machinery Company	229
Advance Machinery Exchange, Inc.	224
Atlas Equipment Company	214
Barron Machinery Co.	224
Bernstein & Co., George M.	229
Botwinik Brothers, Inc.	218
Buffalo Machinery Company	225
Central Machine Tool Corp.	227
Cincinnati Ball Crank Company	224
Cincinnati Machinery & Supply Co.	226
DeWitt Tool Co.	227
Donberg & Danits	219
Dony Machinery Co., D. E.	227
Eastern Machinery Co.	220
Eastman Kodak Co.	214
Emerman & Co., Louis E.	225
Falk Machinery Co.	223
Galbreath Machinery Co.	224
General Machinery Corp.	223
Hasco Machinery Company	222-226
Hill-Clarke Machinery Co.	215, 223
Howarth Machinery Company	222
Hyman & Son, Joseph	222
Industrial Equipment Company	222
Industrial Machinery Co.	???
Inland Machinery Company	229
Indianapolis Machy. & Supply Co., Inc.	220-226
Interstate Machinery Company, Inc.	226-227
Iron & Steel Products, Inc.	224
Lake Machinery Co.	226
Lang Mchy. Co.	227
Leach Machinery Co., H.	218
Machinery Dealers National Ass'n	221
Marsh Machinery Co., A. R.	222
McDonald Machinery Co.	226
Miles Machinery Co.	216
Mills-Gavan Machinery Sales	222
Morey Machinery Co., Inc.	220
Morris Machinery Company	225
O'Brien Machy. Co.	216
Osborne & Sexton Machinery Co.	227
Ott Machinery Sales, Inc.	227
Patron Transmission Company	227
Paul's Motor & Machinery Supply Co.	224
Reconstruction Machine Tool Corp.	224
Reynolds Machinery Company	224
Rosenkraz Machinery Co.	227
Segal Machinery Company	229
Simmons Machine Tool Corp.	217
S & S Machinery Co.	225
Strong Carlisle & Hammond Co.	222
Surplus Material & Machinery Company	224
Toomey Machinery Company, Frank	226
Victor Machinery Company	229
West Penn Machinery Co.	224
Wiggleworth Machinery Co.	227
Zeeze & Co., Alex.	227



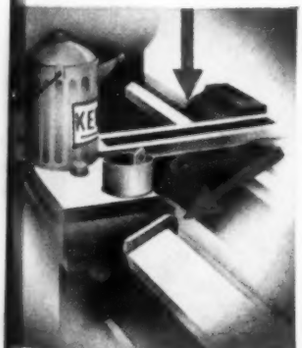


"I'm Tellin' You . . ."

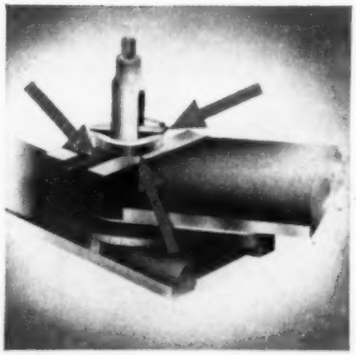
(No. 3 in a series of tips on "Keeping 'em Turning")

by **John Gauche—40 years with LeBlond**

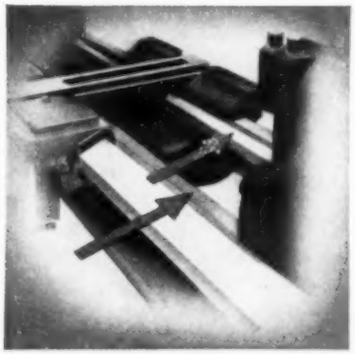
When a lathe hand gets absorbed in turning out a piece of work, it's awfully easy for him to forget that Cleanliness is next to Godliness. But if he does forget, and allows his machine to get choked up with chips and turnings–look out, brother, that's trouble! Just as a reminder, I'd like to point out the spots that need close watching to keep your lathe running accurately and smoothly.



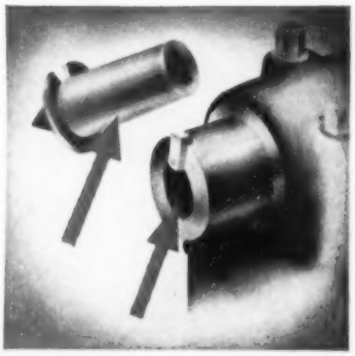
…ipers do a good job of keeping …y turnings out from under the …ge. But when you work with … iron, you should remove the …s occasionally and clean them in …ne to rinse out the dust and grit.



When you place a tool in the tool post, check to be sure there are no turnings between the collar and the compound rest, or between the wedge and the collar. Your tool can't get a firm rest in a dirty tool post.



Don't move the tailstock along the ways without first carefully wiping off all chips. Turnings on the ways will throw the tailstock out of alignment and ruin your accuracy. Also keep tailstock spindle clean.

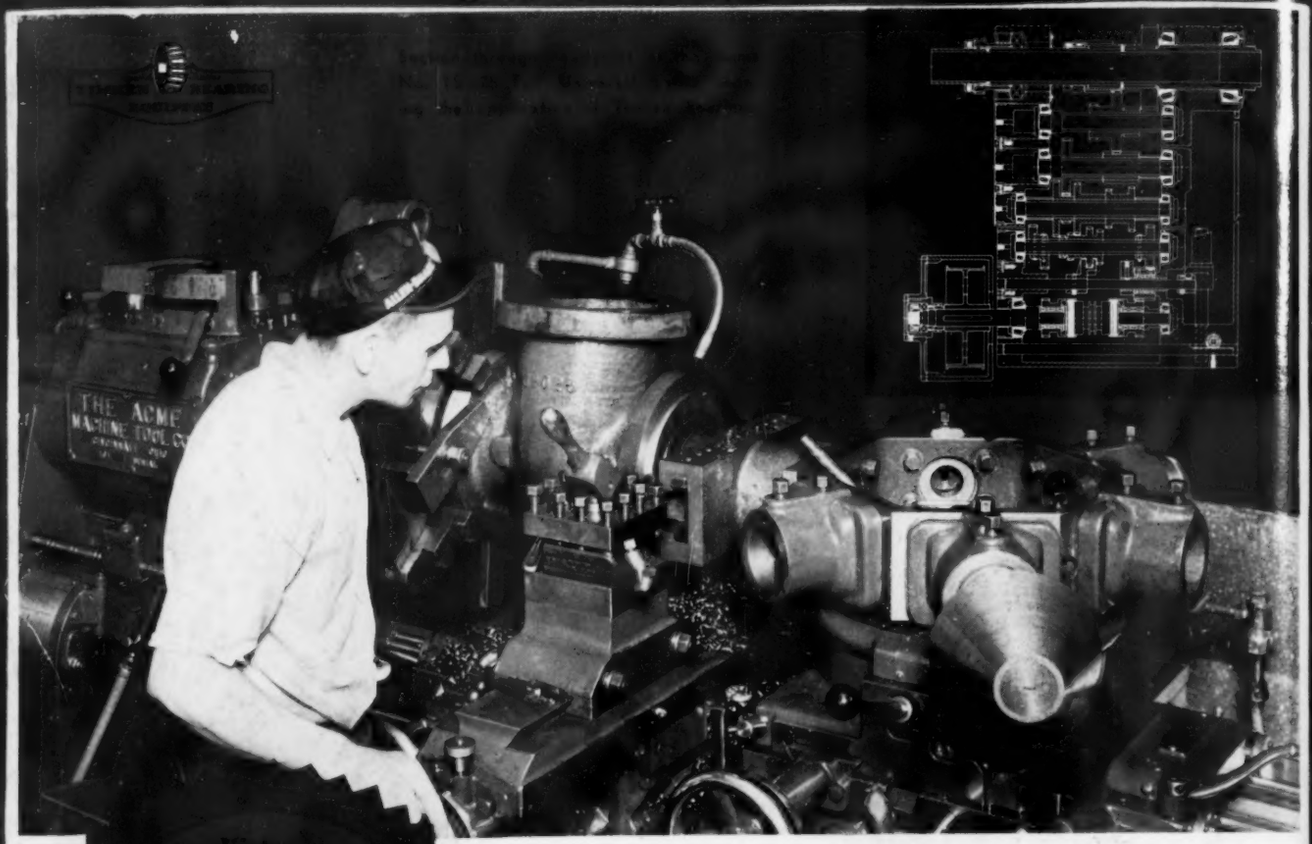


Before replacing center, wipe out the hole and clean the tapered part of the center. When using drills, chucks, or reamers be sure they are tight in the taper hole. If there is dirt between the two, the part will revolve and cut the taper hole.

HE R. K. LeBLOND MACHINE TOOL COMPANY

Cincinnati, Ohio

Largest Manufacturer of a Complete Line of Lathes



Acme No. 1S-25 Full Universal Lathe manufactured by Acme Machine Tool Company, Cincinnati, Ohio and installed in the plant of The Wm. Powell Company, Cincinnati.

Timken Tapered Roller Bearings are practically standard on modern heavy duty machine tool spindles. Many machines also use Timken Bearings throughout the headstock and a considerable number have them in the feed mechanism and tailstock as well.

An extremely high degree of precision is common to all these machines, but in general the more Timken Bearings per machine, the better the performance (implying a combination of precision, speed, endurance, low operating and maintenance costs).

Because of their versatility, Timken Bearings meet every requirement of every bearing position. They eliminate friction and wear; they hold radial, thrust and combined loads in check; they prevent moving parts from getting out of alignment.

Wherever there are bearings in the machines you design, manufacture or buy, make sure they are Timken Bearings.

Manufacturers of Timken Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; Timken Alloy Steels and Carbon and Alloy Seamless Tubing; and Timken Rock Bits.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO